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WE GUARANTEE that of this issue 10,011 copies were printed; that of those 10,011 copies 8,572 were mailed to regular paid subscribers to the Railway Age Gazette and the Railway Age Gazette, Mechanical Edition; 150 were provided for counter and news companies' sales; 189 were mailed to advertisers; 100 were provided for bound volumes, and 1,000 for distribution at Atlantic City.

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Movement of Firebox Sheets

It has been generally believed that there is little definite knowledge as to what actually takes place in the sheets and staybolts of a locomotive firebox, but the statements made by George L. Fowler in his discussion of the committee report on locomotive boilers on Thursday morning indicates that we know infinitely less than we thought we did. It appears from Mr. Fowler's investigations that the staybolts are always moving and always under stress; in fact, that they are practically subjected to the conditions of a vibratory testing machine. The effect of the rigid staybolt and the advantage of the flexible staybolt is indicated from the relative movement of the sheets, which is only half as great with the rigid as with the flexible bolt. The investigation also brought out some definite evidence of the cooling effect of the opening of the fire door, and the change in the movement of the tubes after the throttle is opened is one of the many astonishing features brought out in the investigation. The continuation of this experimental work with the improved apparatus which has been developed should bring out some valuable information as to just what is taking place in the firebox structure when the locomotive is working.

Thin Fires for Stoker Engines

During the discussion of the committee report on Mechanical Stokers the question was raised regarding thin fires for stoker engines. The committee stated that there is sometimes a tendency to carry a fire that is too thin. A thick fire on a stoker engine and a thick fire on a hand-fired engine are two different things and must not be confused by those who have not had extended experience with stoker-fired engines. The operating conditions and the grade of fuel will govern the depth of fire. Where the use of the throttle is intermittent, it can be readily seen that a thin fire, which would require constant stoking to keep it alive, would tend to keep the pop open. On the other hand, with a heavier fire, it would be possible to maintain full pressure without continually feeding coal when the throttle is not open. One of the good features of the stoker is the thin fire it can carry, thus insuring more perfect combustion. But the conditions will determine the correct depth.

A Committee Report Well Presented

The Committee on Revision of Standards and Recommended Practice has received many congratulations on the splendid manner in which its report was presented on Wednesday morning. With its several appendices the report covered 26 pages. So skillfully did the chairman touch on the vital points, hardly using an unnecessary word, that the presentation was made in a few moments and yet the import of the recommendations was thoroughly grasped by all those who were interested. The report also conforms to the suggestions made to the Committee on Specifications by President Gaines that the standard specifications be not too rigid, but that they call for a fair grade of material which will prove satisfactory for general use. This will be less expensive than where each road has different requirements, some of them of a very special nature. The commitee has also kept in touch with other associations, and particularly with the American Society of Testing Materials, with the idea of having uniform specifications.

Superheat and Compounding

In the topical discussion on compounding superheater locomotives the point was brought out that the application of superheaters to compound locomotives and the compounding of superheater locomotives are entirely different matters, the results from which are not necessarily of equal benefit in increasing efficiency. The fact that considerable increase in efficiency may result from the application of superheaters to existing compound locomotives does not argue that the compound feature contributes the same share to the combined result, as indicated by the improvements which may be effected by its application to saturated steam locomotives. Theoretically, however, there seems to be little doubt that the compounding of superheater locomotives may effect an appreciable saving in fuel. This is clearly indicated by the results of the European tests referred to by Lawford H. Fry in opening the topical discussion on Wednesday morning. Undoubtedly similar results could be obtained in this country, but not with the standards of mainatenance now obtaining. The relative value of labor and fuel in European countries, and especially in France and Germany, where the compound superheater locomotive is finding its greatest use, is such that refinements in design intended to increase fuel economy are practicable, which would fail in this country because of the excessive cost of maintenance. The relatively high value of fuel in relation to the cost of labor in Europe as compared with this country, is the basis for the difference in practice existing between the two continents. In calling attention to

the refinements of European practice this fact must not be overlooked. While economy in the use of fuel is constantly demanding increased attention, the cost of labor is also constantly increasing, and the advisability of the use of compounding in connection with superheated steam is unlikely to receive serious attention in this country until existing conditions have been greatly changed.

American and European Locomotive Design

In the refinements which have been and are being made in locomotive design in America, the designers, whether they know it or not, are to a considerable extent following the lines which European designers have followed for years. The restricted loading and clearance limits with which the railways of Europe have to contend forced their mechanical engineers to many expedients in order to reduce the weight of the frames and running parts to a minimum, the saving thus made being employed in increasing boiler capacity. The American designer did not adopt such methods until he was forced to it by the dimensions which American locomotives had reached; but the increasing use of heat-treated and special steels to increase strength and reduce weight is in direct line with European practice. That this development of the American locomotive will continue is certain and it would be well for those responsible for locomotive design to familiarize themselves with European practice, with a view to its adaption to our conditions.

Matters Worthy of Attention

President Gaines, in his opening address, asked some questions concerning motive power matters on which further emphasis may well be placed. Do we know when a new locomotive is placed in service whether its increased weight, capacity and cost are justified? There is too much designing and placing in service of locomotives without enough consideration being given to their suitability for the service in which they are to be used. Is the operating department kept informed of the results of investigations, if such investigations are made, into the means of obtaining the best results from locomotives on the road? This question is not difficult to answer. Such investigations are made infrequently and when made are too often of a nature which does not produce results that are worth keeping on record. How many operating department officers know in detail the savings effected by improvements in locomotives? Yet the operating officer is keenly interested in anything that affects the cost of conducting the operation. Again, how often are subordinates supplied systematically with information so that they may analyze the results of their work and endeavor to make reductions in expenses? These are only a few important items. They will suggest others to anyone taking the time to give them the consideration which they deserve, and are commended to the careful attention of motive power officers.

Cost of Hiring and Discharging Men

An investigation of the employment and discharge of all classes of employees at a number of factories disclosed the fact that of all those engaged during the year 1912 about 73 per cent. were new employees, never having worked in that particular factory previously. Managers stated that in their opinion the amount of money wasted in engaging and discharging employees in large numbers ranged from $30 to $150 per employee. The author of the investigation concludes that the apparently unnecessary engagement of 22,225 employees within one year in the factories investigated involved an economic loss of $774,139, which means that the cost of training a new employee averaged about $35. In suggesting means for avoiding this loss, there are mentioned the exercise of proper methods for taking care of new employees, effective systems of apprenticeship and specialized training, and the regulation of commercial requirements so as to secure a fairly uniform production throughout the year. The effect of an efficient apprentice system in helping to correct such conditions is readily recognized, but the last suggested remedy is extremely difficult of application even in commercial establishments. When we consider the possibilities of its application to railway repair shops, the difficulties are, of course, greatly increased. Traffic conditions require the employment of every available unit of power at certain seasons of the year, while at others many locomotives are kept idle. The conditions at the large repair shops of necessity hinge to a great extent on this, but it seems probable that some improvement could be made in the assignment of locomotives for repairs so as to reduce the fluctuation in the amount of work throughout the year. If any marked improvement were to be made, it would require a careful study of all conditions and co-operation between departments; however, a study of the foregoing figures cannot but be of interest to mechanical department officers, and it is evident that any improvement which will tend toward reducing the number of men who are hired and discharged during the course of the year can have a direct effect on the condition of the company's treasury.

LOCOMOTIVE FUEL ECONOMY

THE problem of fuel economy, with all its ramifications, is without doubt one of the biggest questions with which the mechanical department has to contend. It includes the proper method of firing, the operation of the locomotive, its maintenance and desgin, and the use of fuel saving devices. Each one of these items is a large problem in itself and it would be impracticable to cover the entire subject in one committee report. This year the committee has, very wisely, confined itself to covering thoroughly one phase of the problem—instructions for enginemen and firemen—and has touched lightly on the other important items. These instructions are the first ever published by this association and are presented in a simple and concise manner so as to be readily understood by the engine crews.

Another problem concerning which but little detailed study has been made recently by this association, is that of the drafting of locomotives, this to include the progress of the air and gases from outside of the ash pan to the top of the stack. In a committee report at the recent Fuel Convention, M. C. M. Hatch, of the Delaware, Lackawanna & Western, showed a wide variation in the practices of the railways regarding ash pan opening, finding a difference of from 15.1 to 5.78 per cent in the ratio of air opening in the ash pan to the grate area. He found a difference of from 25.8 to 49.6 per cent in the ratio of air openings in the grate to the grate area. He also found that there is no one front-end arrangement in general use nor a general conforming to the Master Mechanics' Association's recommendation for proportioning the front end. Another feature, as brought out in the discussion by Lawford H. Fry, is that of the firebox volume. With the high volatile coal this is a most important feature. It is well known that the loss of available heat by incomplete combustion is very large and without sufficient firebox volume this will occur.

The effect of improper maintenance on the coal pile, in addition to the imperfect operation of the locomotive, should also receive consideration. Leaks in the flues, packing and front-end all contribute to the wasting of fuel. Worn pins in the valve gear, and improperly maintained bearings on both the cars and locomotives are also a drain on the fuel. These are but few of the many possible problems for a committee on fuel economy to consider.

TODAY'S PROGRAM

FRIDAY JUNE 11, 1915

9.30 A. M. to 1.30 P. M.

Individual Paper on:

Variable Exhausts by J. Snowden Bell.

Discussion of reports on:

Joint meetings with M. C. B. Association.
Revision of air-brake and train signal instructions.
Train resistance and tonnage rating.
Locomotive counterbalancing.
Maintenance and operation of electrical equipment.
Forging specifications.
Boiler washing.
Dimensions of flange and screw couplings for injectors.

Subjects.

Resolutions, correspondence, etc.

Unfinished business.

Election of officers, closing exercises.

Adjournment.

ENTERTAINMENT

10.30 A. M.—*Orchestral Band Concert.* Entrance Hall, Million-Dollar Pier.

3.30 P. M.—*Orchestral Band Concert.* Entrance Hall, Million-Dollar Pier.

9.00 P. M.—*Carnival Dance.* Special Feature, "Charlie Chaplin Fox Trot," Miss E. M. Kegel and Mr. Frank Carlin. Ball Room, Million-Dollar Pier. Don Richardson Orchestra.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS

The eighth semi-annual meeting of the Association of Railway Electrical Engineers will be held as usual at the Hotel Dennis, Atlantic City, on June 14. The meeting will be called to order at 9 a. m. and the various committees will present reports of progress.

ROLLER CHAIRS FOR DANCES

The announcement of the Transportation Committee that roller chairs would be provided free from 8.30 p. m. to 10 p. m., to both of the informal dances on the Pier refers only to the functions held last evening and to be held next Tuesday evening. Roller chairs will not be furnished free to the other informal dances.!

WHERE THE VAUDEVILLE SHOW WILL BE HELD

The vaudeville show on Saturday evening will be held in the Auditorium over Exhibition Hall on the Pier. Probably a good many people do not know just how to reach the auditorium. The way to get to it is to pass through the court and through Exhibtion Hall and up the incline. At the top of the incline members of the entertainment committee will be stationed to direct the crowd where to go.

TRANSPORTATION TO THE GOLF CLUB

The Entertainment Committee has arranged with the Bergdoll Taxicab Co. for special rates to and from the Sea View Golf Club a charge of $5.00 being made for six passengers each way. Machines will be parked at the Marlborough-Blenheim, Traymore and Chalfonte hotels for the convenience of those attending or participating in the golf tournament on Sunday, or machines may be ordered at any time by phoning the taxicab company, phone 600.

INFORMAL DANCE

The informal dance which was held on the Million Dollar Pier last night proved to be a most delightful affair and was very largely attended. The program was rendered by the Don Richardson Orchestra. Miss Betty Lee, who was announced to sing folk songs, has found it is impossble to render these to advantage because of the poor acoustic properties in the ball room. Instead she sang "Isle D'Amour" and "A Perfect Day." The committee in charge consisted of J. F. A. Comstedt, chairman; M. G. Baker, W. K. Krepps, G. E. Ryder, D. E. Sawyer, T. K. Dunbar, R. J. Faure, R. H. Gwaltney, A. B. Wegener and W. H. Bentley.

PURDUE UNIVERSITY DINNER

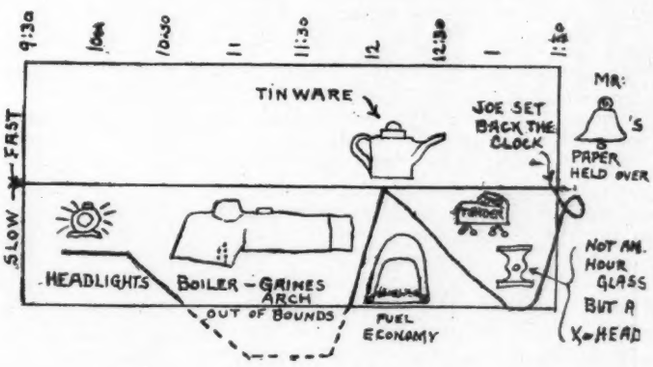
The annual convention Purdue Dinner will be held at 6.30 Saturday evening at the Shelburne. All Purdue men are requested to attend. Those who have not already signified their intention of attending should leave their names with Prof. L. E. Endsley, E. E. Silk or at the *Railway Age Gazette* booth, in order that proper arrangements may be made.

CORNELL DINNER

The annual dinner of the Cornell men attending the conventions will be held at Barney's to-night at 7.30 o'clock. All Cornell men who have not already signified their intention of being present are requested to register to-day at the booth of the Chicago-Cleveland Car Roofing Company, Space No. 506. The guest of honor at the dinner will be Professor Dexter S. Kimball, professor of mechanical engineering of Sibley College at Cornell.

YESTERDAY'S SESSION

We are indebted to Joe Taylor for the accompanying diagram, showing graphically the progress which was made at yesterday's meeting. It really needs no explanation.



COMPARATIVE REGISTRATION FIGURES

Below are given the registration figures for the first day of the conventions for the past four years. The figures for this year should be compared with those for 1913, as the M. M and M. C. B. conventions alternate from year to year in coming first.

	1912.	1913.	1914.	1915.
Members M. M. and M. C. B.	263	374	466	367
Special Guests	169	141	182	135
R. R. Ladies	211	222	200	163
Supply Ladies	164	221	350	163
Supply Men	1149	1264	1169	892
Totals	1956	2222	2367	1720

While there is a substantial decline in the figure for total registration, an analysis of the figures is encouraging rather than discouraging. From the standpoint of all concerned the attendance for railway men is the most important factor and it will be noted that the number of railway men registered the first day was only seven less than in 1913 and was much larger than in 1912. The heavy decline in the total registration is due to the reduction in the numbers of ladies and of representatives of supply companies here, the number of ladies who registered the first day being 119 less than in 1913 and the number of representatives of supply concerns 372 less. The relatively large registration of railway men shows that their interest in the conventions and the exhibit remains as keen as ever.

Master Mechanics' Association Proceedings

Includes Committee Reports on Locomotive Headlights, Locomotive Boilers, Standardization of Tinware and Fuel Economy

President Gaines called the meeting to order at 9.50 a. m. Thursday. The secretary read the reports of the auditing committee and the certified public accountants, which on motion were received and approved.

At the suggestion of D. F. Crawford, chairman of the Committee on Locomotive Headlights, who was unable to be present, the privileges of the floor were extended to J. L. Minick, who presented the report.

LOCOMOTIVE HEADLIGHTS

In connection with the incandescent lamp headlight, the committee feels that the following standards should be adopted in order to direct the development of this type of headlight.

Voltage.—The voltage of the system should be fixed at 6 volts, for the following reasons:

1. This voltage will permit the use of standard 6-volt automobile lamps in the cab, markers, etc. Lamps in the 25-34 volt class, of the proper candle-power for this service, are not now made, and they will be difficult to develop.

2. This voltage will permit the use of incandescent lamps having the strongest possible filament of the most rugged construction. A complete line of 6 and 7 volt lamps has been manufactured for some years past for automobile service. No new sizes need be developed for locomotive service, except that the size and form of filament winding in the headlight lamp will have to be changed slightly to give the proper distribution of light.

3. This voltage will permit the use of a small storage battery on the locomotive, if so desired. Sufficient space is not now available on steam locomotives for 32-volt storage batteries.

4. This voltage can be obtained from a small turbo-generator as readily as any other voltage.

Candle-power.—The Columbus tests show that an incandescent lamp of approximately 50 mean horizontal candle-power will give sufficient light to meet the recommended maximum requirements of 3000 apparent beam candle-power. Concentrated filament tungsten lamps are now regularly manufactured in candle-powers

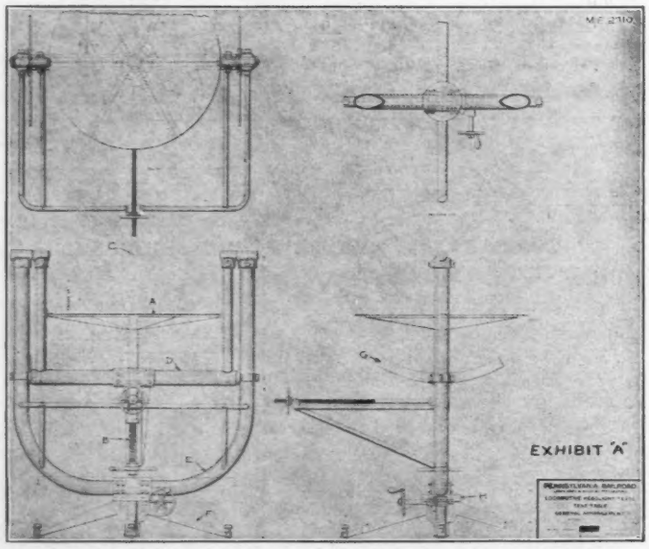


Fig. 1.—Photometer Table for Testing Locomotive Headlights

of 50, 100 and 160 at 6 and 7 volts, for headlight service. The two larger sizes are not deemed necessary by the committee. The committee recommends for use in the headlight a 50 candle-power, 7 volt, G-20 clear bulb, Edison screw base (style 100), loop-back tungsten filament, multiple burning, headlight lamp. (In case gas-filled lamps are used, the filament winding should be of such form and shape as to correspond closely with the form and shape of filament used in the lamp above described, and "gas-filled" must be specified when ordering.)

For use in the cab, markers, etc., the committee recommends a six candle-power, 7 volt, G-10 clear bulb, double-contact bayonet candelabra base (style 1000), tungsten filament, multiple burning lamp.

Standard bayonet double-contact sockets are recommended for bayonet base lamps. Standard Edison screw sockets, equipped with Benjamin lamp grip, or equivalent, are recommended for use with the headlight lamp.

When metal reflectors are used, the minimum nominal diameter

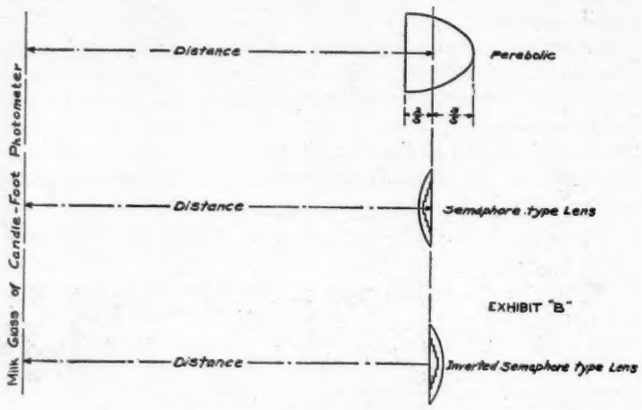


Fig. 2.—Method of Measuring Distance Between Milk Glass and Reflectors and Lenses

should not be less than 16 in. When parabolic glass reflectors or semaphore type lenses are used, the minimum nominal diameter should not be less than 12 in.

Method of Photometering.—A photometer table, constructed entirely of metal, has been developed, being so designed that it may be readily handled or moved about, and may be set up in

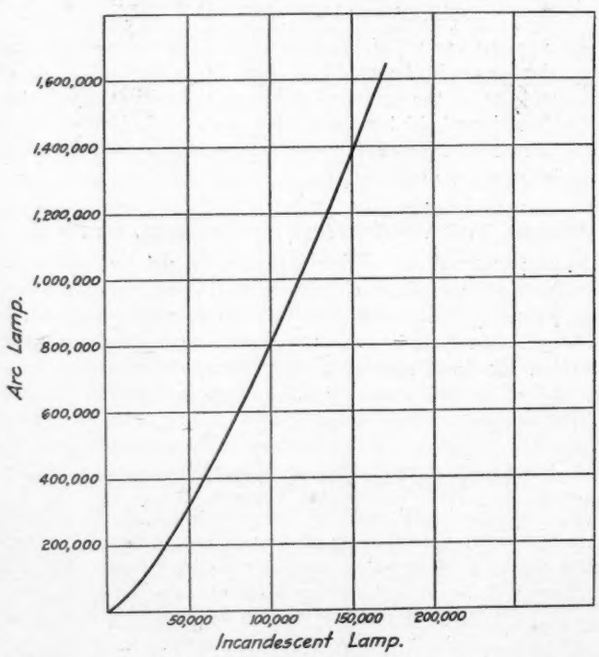


Fig. 3.—Ratio of Values of Arc and Incandescent Lamp Headlights

any location where sufficient floor space is available. This table is shown in Fig. 1. It consists of a platform (*A*) on which the headlight is mounted. This platform (*A*) is adjusted vertically by a screw (*B*) until the axis of the headlight corresponds with the point (*C*). The platform (*A*) and its adjusting-screw (*B*) are supported by a cradle (*D*), swinging in a vertical plane above a horizontal axis through the point (*C*), the whole being supported by a U-frame (*E*) of steel tubing. The U-frame is in turn supported by and rotated horizontally on a metal base (*F*),

provided with adjusting-screws for leveling. The platform (*A*) may be rotated about three degrees in either direction for finding the optical axis of the headlight. The scale (*G*) indicated the vertical angle and the scale (*H*) the horizontal angle through which the headlight is rotated. Both of these scales should be provided with verniers for accurate reading.

Space not less than 9 ft. wide by 9 ft. high and 30 or more ft. in length, depending upon the type of headlight to be photometered, must be provided and enclosed on all sides with light, tight material. Heavy canvas or oilcloth may be used for this purpose, and all interior surfaces must be painted dull black to avoid reflection. A candle-foot photometer is mounted at one end and the headlight table at the other end of the room. Between these a series of at least three canvas screens, painted dull black on both sides, should be attached to the ceiling, floors and walls. A hole approximately 1 ft. square should be cut in each screen on the axis of the headlight. The candle-foot photometer is mounted outside the photometer room, the milk-glass tube projecting through the end wall on the horizontal axis of the headlight.

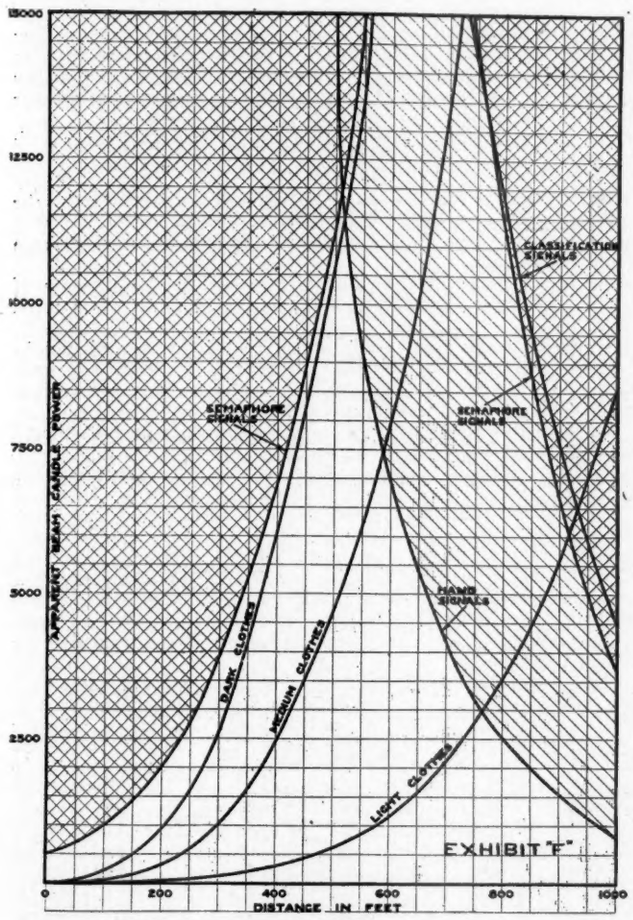


Fig. 4.—Dangerous Conditions for Various Apparent Beam Candle Powers.—The cross-sectioned space represents the danger zone

The headlight should be set up at the following distances from the milk glass of the candle-foot photometer, depending upon the apparent beam candle-power of the headlight, as follows:

Apparent beam candle-power of headlight.	Distance of headlight from milk glass of candle-foot photometer.
1000 or less	15 ft.
1000 to 10,000	25 ft.
Above 10,000	50 ft.

The method of measuring this distance for parabolic reflectors, semaphore type of lenses, or inverted semaphore type of lenses is shown in Fig. 2. Readings are taken by rotating the headlight, both vertically and horizontally, to throw on the milk glass of the candle-foot photometer those rays of light corresponding to the reading stations recommended in last year's report.

As a matter of general information the committee has added Figs. 3 and 4. Fig. 3 is based upon the Columbus tests, and shows the ratio existing between arc and incandescent-lamp headlights. That is, any object that may be seen with an arc headlight of 800,000 apparent beam candle-power may be seen just as readily with an incandescent-lamp headlight of only 100,000 apparent beam candle-power.

Fig. 4 is also based on the Columbus tests. All of the curves indicating dangerous conditions, as referred to in last year's report, have been reduced to a common scale and plotted on one sheet. The cross-sectioned space is the "danger" zone and the clear space is the "clear" zone. In selecting a safe headlight it is evident that its apparent beam candle-power value must lie within the clear space.

The Sixty-third Congress passed an amendment to the Locomotive Boiler Inspection Bill regarding the inspection of locomotives and tenders, including "all parts and appurtenances thereof." It is evident from the foregoing that this subject will be active for several years to come. For this reason the committee feels that it should be continued so as to collect for ready reference any new information that may develop or conduct any tests that may be desired.

The report is signed by:—D. F. Crawford (Penna. Lines), Chairman; M. H. Flynn (M. C.); C. H. Rae (L. & N.); F. A. Torrey (C., B. & Q.); H. T. Bentley (C. & N. W.); M. K. Barnum (B. & O.), and Henry Bartlett (B. & M.).

DISCUSSION

President Gaines: Have you tried the application of the incandescent lamp to the old arc outfits in any of your tests?

J. L. Minick: The equipment used consisted entirely of new reflectors. They were made up by several manufacturing concerns and we did not try the adaptation of incandescent lamps to reflectors which had formerly been used with arcs. We did use incandescent lamps with certain reflectors formerly used with oil. We got very reasonable candle powers. The Pennsylvania 16-in. reflector has quite large openings in the side for illuminating the locomotive numerals. The holes for the oil lamp are also very large. It was found that by closing first only the numeral holes the candle power of the headlight could be increased approximately 50 per cent, and by closing up the two holes used for the chimney it could be increased approximately 100 per cent by using an incandescent lamp.

J. L. Minick: There are about 2,000,000 six-volt starting and lighting generators used in automobile service. There are a great many turbo-generators of somewhat larger size used. They will vary anywhere from 500 to 600 watts up to 1,000 watts and apparently from the steam end these are working satisfactorily. It remains, therefore, to get a smaller turbine to drive the six-volt generator intended for use with the incandescent lamp, which does not require as much power as the arc light headlight. It is purely a matter of reducing the size of the turbine slightly. The difficulty in this lies in getting the steam nozzle small enough to deliver just the right amount of steam.

W. E. Dunham (C. & N. W.): In noting the number of states that now require the fifteen hundred candle power lamp, it would seem that there are a great many equipments now in use which it would not be desirable to throw away. In changing to the six-volt equipment and abandoning our thirty-volt equipment, it will be difficult to win the support of those who handle the pocketbooks of the railroads. We have been experimenting on the Northwestern with incandescent lamps of the 25 to 34-volt class and we are able to get good lamps and good results without changing the generators or any other part of our present equipment on the locomotive.

M. K. Barnum (B. & O.): It is quite probable that a plan could be worked out by which the present equipment can still be used in connection with lower voltage if they desire to do that, and if they do not desire to do that, there is nothing to prevent their continuing the present equipments as they are.

J. L. Minick: The statement of the committee is not to the effect that there are no thirty-two volt headlight lamps made. The statement is made that lamps of the proper candle power for use in the cab and as markers of the 25-34 volt class are not made. There is a series of incandescent lamps made for headlight service which correspond exactly to the size given for the six-volt lamps, that is 50, 100 and 160 candle power, and they can be substituted for the present arc light headlight equipment, but when it comes to cab lights and marker lights, you will either have to have special lamps made up or use lamps which are too large and consume too much power.

E. W. Pratt (C. & N. W.): We are buying for cab lights and markers 32-volt lamps, which cost 11 cents each. These are about 25-watt lamps.

J. L. Minick: That is equivalent to about 20 candle power, and not more than five or eight candle power is necessary. Five or eight candle power cab lights in the proper reflector will give as good results.

E. W. Pratt: We hope that the various states whose laws are so widely different will change their laws, or will accept the incandescent light headlight in place of the arc light headlight. I would like to ask if these standard headlights can be rewound to six volts.

J. L. Minick: It would probably cost no more to buy the six volt equipment, than it would to go to the expense of rewinding the other.

J. A. Pilcher (N. & W.): Could not the cab lights and auxiliaries be run in series using low voltage lamps and in this way keep down the power?

J. L. Minick: That is possible.

J. H. Davis (B. & O.): If the committee's recommendations are accepted, how are we to comply with the law where it states that 1500 candle power, unreflected, shall be furnished? The maximum candle power of the lamps specified for six volts is 160 candle power.

C. E. Fuller (U. P.): It is presumed that there will be a federal law governing headlights, and in that case the best legal advice we have is that it will automatically wipe out all state laws. We now have such law, but there have been no requirements framed under it. We presume that when these requirements are framed they will be Federal requirements, so that all the railroads in the United States will be operating under the same requirements.

W. H. V. Rosing (St. L. & S. F.): We use the same kind and style of lamps in cabs as we do in train lighting, and it seems to me that the locomotive and the passenger train ought to be considered together. By using the same lamps in both engine and train, even though the higher voltage might be more expensive on the locomotive, that might be offset by not having to carry a separate stock of lamps at points where repairs would be required.

The committee was continued for another year.

DESIGN, CONSTRUCTION AND INSPECTION OF LOCOMOTIVE BOILERS

During the past year the committee has made a complete investigation of the methods in vogue for figuring stresses in locomotive boilers. The replies from 44 roads indicate that in some essential details, such as figuring efficiency of seams, there was no variation in methods, while in other details there was at times

C. E. Fuller
Chairman, Committee on Design, Construction and Inspection of Locomotive Boilers

a wide variance of assumptions. The following rules for determining stresses in locomotive boilers are presented as Recommended Practice:

RULES FOR DETERMINING STRESSES IN LOCOMOTIVE BOILERS.

Longitudinal Barrel Seams and Patches.

(a) In figuring net section of plate, use the actual diameter of rivet hole.

(b) In figuring rivet shear, use the actual diameter of the rivet after driven.

(c) In figuring stress in plate and shear in rivet, in case the barrel is not cylindrical where it joins the firebox wrapper sheet, use the maximum diameter. Surfaces subject to bending action under pressure must be adequately braced to prevent bending stresses.

(d) When boiler shells are cut to apply steam domes or manholes, the amount of metal in the flange and liner shall be equal in strength to the metal removed. When a separate flange is used at the base of the dome, the entire net area of it shall be assumed as reinforcement. Where the dome sheet is flanged direct to the shell of the boilers, a vertical distance of 2 in. from the base of the flange shall be assumed as reinforcement, using the net area after the rivet holes are deducted and using 28,500 lb. tensile strength per square inch as the ultimate strength, if the dome sheet is welded vertically.

Longitudinal Gusset Braces and Flat Surfaces.

(a) In figuring stress in diagonal braces, allowance for the angularity of the brace shall be made.

(b) The sectional area of the brace and the strength of the attachment of the brace to the shell shall both be investigated and the lowest net strength shall be used.

(c) In determining the strength of the gusset braces for supporting the back head and tube sheets, use 100 per cent of the rivet-bearing area, 80 per cent of the rivet shear area and 90 per cent of the gusset plate area, measured at right angles to the longest edge of the gusset sheet, and of the three, select the minimum value.

(d) The calculation of stress in gusset braces shall cover both the section of the plate and the strength of fasteners, and the lowest net strength shall be used.

(e) In figuring flat stayed surfaces, such as back heads, the boundary of the unsupported flat surface shall be located at a distance equal to the outside radius of the flange measured from inside of the shell.

(f) No supporting value shall be assigned to the stiffness of flat plates on flat surfaces, as it is too small to be of material value.

(g) Reinforcing plates, such as back head liners, shall not be figured as having any staying or supporting value, but shall merely be considered as mechanical reinforcements for various attachments, such as longitudinal stays, staybolts, etc.

(h) The distance beyond the outer row of flues on tube sheets, assumed to be self-supporting, shall be 2 in.

(i) In calculating the area to be stayed on the front tube sheet, the area of the dry pipe hole shall be deducted.

(k) Tee irons or other members, when used subject to bending, shall be calculated without addition for the strength of the plate, and the stress in such beam and its abutments must not exceed 12,500 lb. per sq. in. The spacing of the rivets over the supported surface shall be in conformity with that specified for staybolts. No allowance for value of such beams shall be made in calculating the total area of longitudinal braces that may be attached thereto.

(l) Where there are a number of diagonal stays supporting a flat surface, such as the back head or front tube sheet, the proportion of area allotted to each brace shall be as follows: Divide the entire net area to be stayed by the entire net area of braces. If it is felt that any individual brace is so segregated as to receive more than its fair proportion of the load, it shall be investigated separately as to the area which it supports.

(m) Patches when applied to the barrel of a boiler shall be designed with longitudinal and circumferential seams at least equal in strength to the main longitudinal and circumferential barrel seams. Patches may be applied to flat stayed surfaces with properly designed single-riveted seams without impairing the strength of the sheet.

Staybolts—Radial Stays and Crown Bar Bolts.

(a) In figuring the net area of staybolts to obtain the stress, the area of the tell-tale hole shall be deducted.

(b) When figuring the area at the root of the thread, the area must depend upon the type of thread used, namely, United States V or Whitworth threads, as the case may be.

(c) In determining the area for figuring stress on staybolts, the area of one staybolt shall be deducted from the rectangular area included between any four staybolts.

(d) In boilers with crown bars supported on firebox side sheets and sling stays, the sling stays shall be considered as carrying the entire load.

The report is signed by: C. E. Fuller (U. P.), Chairman; M. K. Barnum (B. & O.); J. Snowden Bell; C. B. Young (C., B. & Q.); D. R. MacBain (N. Y. C.); A. W. Gibbs (Penn.), and R. E. Smith (A. C. L.).

DISCUSSION

J. Snowden Bell: In justice to the committee and particularly to the chairman there should be a brief explanation made to the Convention of the brevity of the report and its failure to deal with the question of the design of locomotive boilers.

Soon after that Committee organized it came to our knowledge that there was a committee of the American Society of Mechanical Engineers appointed to formulate a code of specifications for the construction of steam boilers and other pressure vessels, which naturally included air-brake reservoirs, gas tanks, etc. That committee published and sent out a preliminary report. We also learned that they proposed to send copies of that report to the legislatures of seven different states, even before it had been approved by the society, with a view to guiding legislation. There were a great many very objectionable provisions in it regarding the factor of safety of pressure vessels other than steam boilers and stationary boilers, a large number of which are used by railroads. We deemed it to be most important to endeavor to obtain a modification of such of those provisions as were detrimental to the railroads and we met with this committee. There were four different meetings devoted entirely to a consideration of the proposed code.

There was also correspondence with the committee on the relation of railway operation to legislation, with which our committee was closely in touch. We succeeded in obtaining modification of the report, the first draft of which has been revised three times; and this morning I saw the fourth revision. We have not obtained all we wanted, but great improvement has been made upon the original drafts of the report.

J. A. Pilcher (N. & W.): It seems to me that item (i) in the report is wrong, because the pressure coming on the pipe itself is finally delivered on the front sheet around its circumference.

M. H. Haig (A. T. & S. F.): A great many of the boiler parts have already been figured, but there are still more to be figured. It is necessary from time to time to train men for calculating of the parts in reinforcing and maintaining boilers, and while the men responsible for the correct reports check them very carefully, their work must be supplemented by those trained to do the original figuring. Therefore I feel that the simpler these reports and explanations are, the greater their usefulness. Item (a) under Longitudinal Gusset Braces and Flat Surfaces I presume includes a bar brace or diagonal brace as well as the gusset. I think it would be well if this could be explained still further, to show just how that angularity is taken care of for the benefit of those who do the work. Referring to item (e) under the same heading, I would like to suggest that the unsupported flat surface be located a distance equal to the outside radius of the flange plus one inch. I think the additional area is well taken care of by the curve surface.

G. L. Fowler: A year ago when the report of this committee was presented it was announced that there were to be some investigations made during the year that might be of interest to the convention at this time. The results are tentative and I do not want them to be considered in the slightest as demonstrations. They are merely indications of what is happening in the locomotive fire box, and as the construction of the box is to a great extent dependent upon these conditions they are presented to you.

The object of the investigation was to determine the relative amount of movement between the two sheets of the side water leg of a locomotive fire box by which the amount of deflection of the staybolts might be determined. In addition to that we made an approximate determination of the temperatures of the two sides of the inside sheet. Of course the work at the start was entirely without any precedent. I had absolutely nothing to go by and it was a mere matter of guess as to where we were going to land. The credit for this work is due to D. R. MacBain, Superintendent Motive Power and Rolling Stock, New York Central. He supplied the two boilers for the purpose, with new fireboxes especially constructed. The fire-boxes had the grates about eight feet long and five feet wide. One firebox had a complete installation of one-inch rigid staybolts put in in the usual manner; the other had a complete installation of Tate flexible staybolts throughout. The first bolts tested were the top row at the front, just below the crown sheet. My apparatus was so designed that there was no lost motion in it and it was of such a character that I could multiply the motion between the outside and inside sheets indefinitely, using a radiating mirror and a reflected light. I started in one evening (the work was all done at night) and told the fireman to get up steam and to pay no attention to me. I wanted round house practice. I waited about twenty minutes and went to my apparatus to get a reading. I found that whereas my divided beam of light that carried the motion on the outside was there, the other one had absolutely disappeared. It was finally located off about five or six feet, so far away that the reading was useless. The next night I moved my instrument up closer to get the light beam under control, and then surprises began. That I may be understood in speaking of the expanding of the sheet downward, backward and forward movement, means that the inside sheet moves down or back or forward relatively to the outside sheet. The whole apparatus travelled with the outside sheet. I found that the sheets began to show movement and expansion within a minute of the time the lighted waste was thrown in to light the fire. A curious thing about the performance was that they almost invariably went in the unexpected direction. The front corner of the sheet, instead of going up and forward, as we would expect with the heat applied, went down and back. It did not go much more than .001 in. and then it started up. It was a constant movement throughout the whole proceeding. At the end of about twenty minutes it had reached its maximum forward movement. Then as the steam began to rise it went up, and while we had steam pressure on it kept moving, coming down back practically to its original position when the boiler was blown down. This was the case in all of the investigations.

In our tests we carried 200 lb. pressure, which would be raised in from 55 minutes to 1½ hours, then the pressure was held, with both pipes blowing, for about 15 min., after which the fire was dumped and the pressure blown down through the blowers in the stack. When that was not enough I opened the controller. The pressure was reduced about one point per minute, so that it took about three hours to drop the steam pressure; and in no instance did the boiler come back to its original position until the steam pressure was all drawn. In some cases it did not come quite back. In making the comparison between a flexibly and rigidly stay boiler the amount of movement of the upper corner at the front end of the flexibly stay boiler in comparison with the rigidly stay boiler was as 31 to 13. That is, the maximum deflection for the stay bolt of a flexibly stayed boiler was .031 in., for a rigidly stayed boiler it was .013 in. Going to the back end of the same row of bolts the movement was toward the back, but practically the same. We then came to the middle bolt in the center of the boiler where we would expect to find the neutral zone of no motion; but it is only an instantaneous neutral zone. It is varying from front to back and up and down all the time, but the limitations of the movement with the flexibly and rigidly stayed boiler was very marked. The total horizontal motion of the rigid bolt was about .026 in.; the total movement of the flexible bolt was about .042 in., about twice as much. That the rigidly stayed boiler only moves about half as far as the flexibly stayed boiler represents a fair average of the results obtained. I found on the middle row of bolts and as I came farther down, a phenomenon that at first was difficult to explain. The first movement of the inner sheet was down and the downward movement increased as we approached the mud ring. My apparatus was so designed as to measure the apparent movement of the two sheets, so if there were a buckling of the sheets there might apparently be a very decided downward movement when there was none at all; but of course there was a bending of the sheet or of the stay. I have redesigned the apparatus to eliminate this weakness, and am pleased to say that the facilities will be afforded this fall to go into the same two boilers again with an apparatus that will measure not only the actual relative movement of the two, but any buckling that may occur in the inside sheet.

As far as we have gone we have determined that the staybolt is in constant motion during the entire time the boiler is hot; that it is always bent when it is under stress, and that the maximum deflection of the bolt occurs before any pressure appears on the gage. In addition I put gages in the throat sheet, in the roof sheet and in the back head, to measure the in and out movement between these sheets, and the back tube sheet, the crown sheet and the back sheet in the fire box. The indications from the throat sheet and the back head were not very consistent, but the consistency of the movement of the crown sheet to the roof sheet was remarkable. The very instant the fire is kindled and begins to throw out any heat the crown sheet begins to go up relatively to the roof sheet. It goes up quite rapidly until the first indication of pressure appears, when it begins to drop, and in almost every instance it dropped well below its normal position when we had reached full steam pressure. In addition an attempt was made to get at the relative movement of the back tube sheet to the shell. There was a washout plug located about three or four inches ahead of the back tube sheet. The apparatus was connected to a tube through this hole. Whether the motion of the tube was entirely transferred to the tube sheet, I cannot say, but indications are that it was. The moment that we built our fire the tube began to move back. We took the valves out of the engine, so that the throttle could be opened and the fire driven for about half an hour with the throttle wide open. When getting up steam, that tube moved back with very great steadiness, but the instant the throttle was opened the movement became very rapid and

within five minutes after we had opened the throttle it had moved back 50 per cent farther than it had during the whole period of getting up steam. Then it began to adjust itself and came back into its original position again at the time of reaching the steam pressure. When I was measuring in that front staybolt I said that the first movement of the sheet was to the rear. At the end of ten minutes after the fire had been built the sheet had moved back .002 in. When the apparatus was attached to the tube it also moved back .002 of an inch, showing that probably the first backward movement of the sheet was due to a direct thrust from the tubes.

We also made an attempt to get at the temperatures of the two sides of the sheet. That was done with ordinary thermocouples. I went up over the top of the arch for the first investigation. There conditions were found to be what I would consider normal; the temperature of the water side was a little above the water temperature. On the other side it was about 750 deg. F. The apparatus was next moved back towards the end of the fire-box and during the early parts of getting up steam conditions were normal. When pressure was up, however, I found that the fire side of the sheet was about 50 deg. F. colder than the water side. My first conclusion was that the apparatus was out of order until attention was called to the smoke tube holes at the side. The apparatus was located about six inches ahead of the back smoke tube hole. This was plugged, and in less than two minutes the temperature was up where it ought to be. The cold air coming through the tube, flowing along on the side of the sheet, had cooled the sheet locally until it was below the water temperature. The apparatus was then located back of the fire door. It was possible instantly to tell when the fire door was opened, from the cooling of the sheet. The cool air coming in from the smoke tubes and chilling the sheets explains the cracking which is apt to occur around these holes, and the effect of the opening of the fire door is a good argument for the use of mechanical stokers.

E. W. Pratt: I would like to ask Mr. Fowler whether the boilers tested had wide fire-boxes with straight side sheets, or narrow fire-boxes with O. G. curves, and whether sloping heads or straight heads?

Geo. L. Fowler: They were wide fire-box boilers with sloping sides and slightly sloping crown sheets.

(The report of the committee was accepted and the recommendations will be submitted to letter ballot.)

STANDARDIZATION OF TINWARE

The committee has carefully reviewed the report submitted one year ago and has made some corrections, though no important changes in the details of any of the articles submitted at that time have been made. It has corresponded with a number of the leading railroads, secured blue-prints of the tinware they are using in their various departments, and has incorporated in its report items that it feels would be of general interest. The committee, in preparing this report, has received some very valuable suggestions from the Storekeepers' Committee, the manufacturers of tin plate, and some of the manufacturers of tinware.

The committee can not hope to present dimensions that will be adopted by all railroads. Many of the roads now have their standards; for various reasons they do not wish to depart from them. There are railroads, however, that have not adopted a standard, and while the committee has studied principally the method of construction and the material to be used, it has also selected the dimensions that in its judgment will be most suitable for the service for which each article will be used.

In the prints submitted the committee has endeavored to cover every detail, making parts interchangeable where this is practical. It will be noted that the joints are double-seamed and the detail of the seam is carefully outlined. Fig. 1 gives the description and name of the joints used in the construction of this tinware. The material is specified, standard kettle ears are used, handles are wired for stiffness and the diameter of the wire is in proportion to the capacity of the article, the can tops are interchangeable in groups, and the spouts are carefully braced to withstand rough service. The following is a brief description of each part recommended:

M. D. Franey
Chairman, Committee on Standardization of Tinware

Fig. 2 is a one-pound emery can, with a small opening which directs the emery onto the spot where it is required. There is a remarkable saving in the amount of emery used with a can of this type.

Fig. 3 is a typical funnel which in sizes of one pint, one quart and one gallon should take care of all requirements in the mechanical department.

Fig. 4 is a typical measure which may be made in one pint,

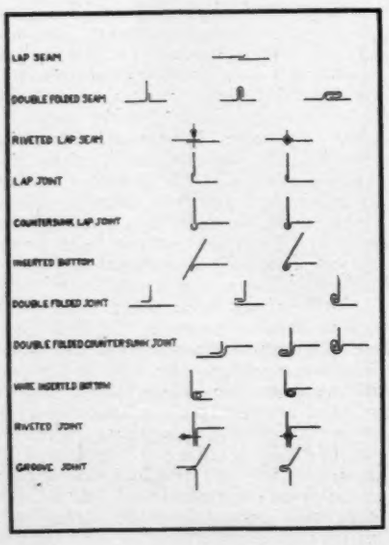


Fig. 1—Typical Seams and Joints

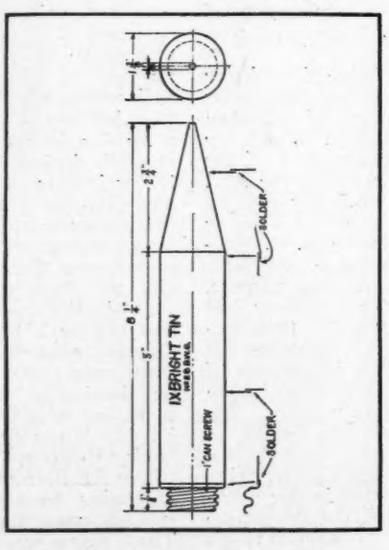


Fig. 2—One Pound Emery Can

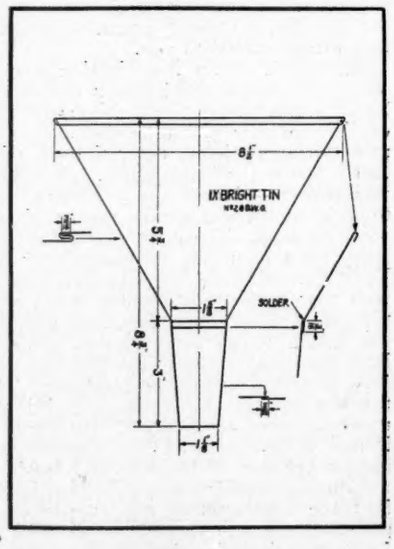


Fig. 3—One Gallon Funnel

one quart, two quart and one gallon sizes. The committee recommended for the one quart size a depth of 4 1-16 in. and a diameter of 4¼ in.; for the two quart, depth 5 7-32 in., diameter 5 5-16 in.; and for the one gallon size, a depth of 6 15-32 in. and a diameter of 6¾ in. The dimensions of the pint measure are shown in Fig. 4.

Fig. 5 is a plain and economical form of coal hod.

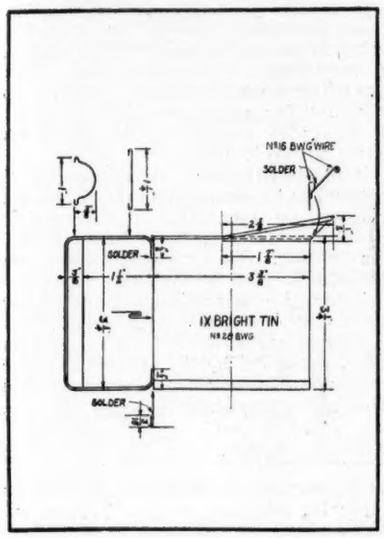


Fig. 4—One Pint Measure

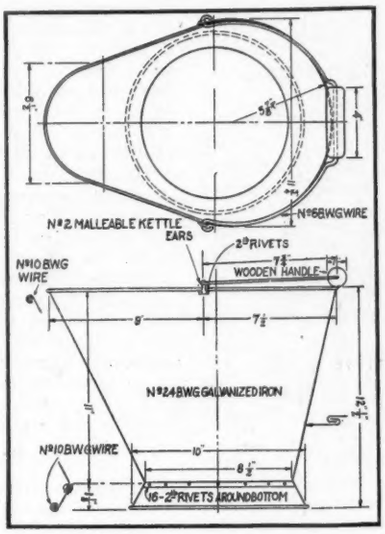


Fig. 5—Coal Hod

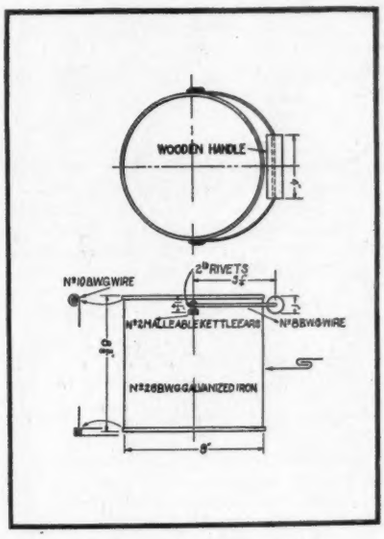


Fig. 6—Two Gallon Pail

Fig. 6 is a two-gallon pail. A four-gallon pail may be made similar to this with the depth of 10¼ in. and a diameter of 10¾ in.

Fig. 7 is a two-gallon journal oil can with a removable brass tip so that the size of the hole may be varied as required. The use of this oil can is not recommended in engine houses.

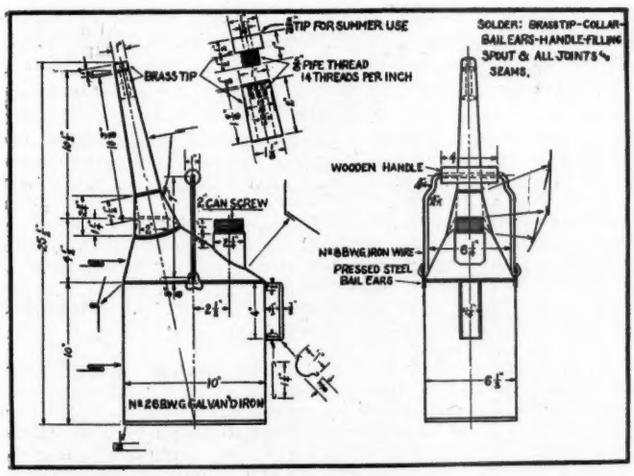

TIP FOR SUMMER USE
SOLDER: BRASS TIP-COLLAR-BAIL EARS-HANDLE-FILLING SPOUT & ALL JOINTS & SEAMS.
BRASS TIP
PIPE THREAD 14 THREADS PER INCH
WOODEN HANDLE
CAN SCREW
N°8 B.W.G. IRON WIRE
PRESSED STEEL BAIL EARS
N°26 B.W.G. GALVAN'D IRON

Fig. 7—Two Gallon Journal Oil Can

(Note.—The report also included illustrations of the articles submitted last year by the committee with a few minor changes and other lesser important articles—Editor.)

The report is signed by:—M. D. Franey (N. Y. C.), chairman; J. C. Mengel (Penn.); W. C. Hayes (Erie); G. S. Goodwin (C. R. I. & P.), and W. O. Moody (I. C.).

SUPERHEATER LOCOMOTIVES

[In view of lack of new material concerning superheater locomotives the committee did not present any written report. It submitted however the results of further tests made by the Pennsylvania Railroad on its Class E 6s engines as published in the P. R. R. pamphlet No. 27 with a recommendation that it be incorporated in the proceedings. This recommendation was adopted.—Editor.]

FUEL ECONOMY

An effort is made this year to limit the report to the consideration of a few of the leading essentials of fuel economy.

DESIGN OF LOCOMOTIVES.

That design of a locomotive boiler and firebox, together with the appurtenances, which will permit of the largest possible amount of evaporation from a given amount of combustible burned, has the maximum efficiency, and is, therefore, the best boiler from the standpoint of fuel economy. Greater attention is being given to the design of boilers, fireboxes, grates, ash pans and front ends than ever before, as all of these parts are interdependent and should bear a definite relation for the best results, and are influenced by the nature of the fuel available.

A study of certain ratios in locomotives constructed within the past 2 years, and in others built 10 or 12 years ago, shows the trend of locomotive design in those respects which have the greatest influence on fuel consumption and steaming capacity. The data shown below are the averages for a large number of bituminous and anthracite burning locomotives of the 4-6-2, 4-6-0, 2-8-0 and 0-6-0 types.

1.—BITUMINOUS.

	Ratio Total Evaporative Heating Surface to Grate Area.		Ratio Firebox Heating Surface to Total Evaporative Heating Surface.	
Type of Locomotive.	1913	1903	1913	1903
4–6–2	65.9	70.9	6.4	5.4
4–6–0	52.3	62.8	7.8	6.5
2–8–0	53.3	60.1	6.7	5.7
0–6–0	53.0	71.8	8.3	6.0
Average	56.1	66.4	7.3	5.9
	Per cent. change Dec. 15.5 per cent.		Inc. 23.7 per cent.	

2.—ANTHRACITE.

4–6–0	30.0	34.8	8.0	6.5
2–8–0	31.1	37.9	8.3	6.1
Average	30.5	36.3	8.1	6.3
	Per cent. change Dec. 16 per cent.		Inc. 28.5 per cent.	

The changes in these ratios are, without doubt, steps in the right direction.

The advantage of large heating surfaces and large grate areas in increasing the evaporation from a unit amount of fuel consumption over that from a similar locomotive with smaller heating surfaces and grate area, is clearly shown by an evaporation test recently conducted at the Pennsylvania Railroad testing plant at Altoona, between a Consolidation type and a Mikado type locomotive. The principal dimensions of the two locomotives and a summary of the data follow:

PRINCIPAL DIMENSIONS.

ITEM.	Consolidation.	Mikado.	Per Cent. Increase Favor of Mikado.
Cylinders	24 by 28 in.	27 by 30 in.	.....
Drivers	62 in.	62 in.	.....
Boiler pressure	205 lb.	205 lb.	.....
Smallest diameter of boiler	76¾ in.	76⅝ in.	.....
Length of flues and tubes	15 ft. 0 in.	19 ft. 0 in.	.....
Heating surface, flues and tubes	2 841.2 sq. ft.	3 746.8 sq. ft.	.....

ITEM.	Consolidation.	Mikado.	Per Cent. Increase Favor of Mikado.
Heating surface, superheater.	1 173.3 sq. ft.	1 730.9 sq. ft.	.....
Heating surface, firebox....	187.0 sq. ft.	288.6 sq. ft.	.....
Heating surface, total.....	4 201.5 sq. ft.	5 766.3 sq. ft.	37.2
Grate Area	55.1 sq. ft.	70.0 sq. ft.	27.1
Weight on drivers.....	219 900 lb.	235 800 lb.	.....
Total weight of engine.....	249 599 lb.	315 600 lb.	.....
Total tractive power.....	42 661 lb.	57 850 lb.	.....

SUMMARY OF TEST DATA.

Dry Coal Fired Per Hour, Lb.	Water Evaporated Per Hour, Lb. Consolidation.	Mikado.	Per Cent. Increase Favor of Mikado.
2 000	17 000	17 000	0.0
4 000	27 000	30 000	11.1
6 000	32 500	43 000	32.3
8 000	34 500	52 500	52.2

These figures clearly show the advantage of the large heating surface and large grate area, and that the economy increases with a decrease in the rate of combustion.

The above testing-plant figures are verified by the results obtained from a road test on the Chicago & North Western, reported in the *Railway Age Gazette* of January 15, 1915, pages 93-94. The locomotives compared were of the Consolidation and Mikado types, each equipped with superheater and brick arch.

Taking advantage of the opportunity afforded by locomotives with trailing trucks to increase the size of firebox and grate area over those proportions in locomotives without trailing trucks, affords a valuable means for reducing the fuel consumption on a ton-mile basis.

The design of exhaust nozzles to suit the various conditions, and as a factor in fuel economy, is very important. A number of roads have experimented with special types of nozzles, and claim a considerable saving in fuel as a result. The committee feels that the subject presents a fertile field for future investigation, due to changed conditions since previous reports were made.

The practice regarding the amount of air opening in ash pans varies between wide limits, ranging from 3 to 18 per cent of the gate area for bituminous and from 10 to 33 per cent for anthracite locomotives. These figures include all classes of service. The importance of air openings through the ash pan should not be overlooked, and it would be well to establish definitely the minimum opening in the ash-pan as a percentage of the grate area. From the best data that the committee has been able to obtain thus far, it appears that this should not be below 12 per cent for locomotives having 70 sq. ft. of grate area, and this percentage should be increased with smaller grate areas.

The almost general application of superheaters and brick arches, not only to new locomotives, but also to many older ones, should not be lost sight of in this connection, as both are important factors in fuel economy and smoke reduction. The practice of welding flues into the back flue sheet is a step in fuel economy. because leaks in the firebox are reduced and the fire does not have to be drawn so frequently for repairs. Care should be taken in the design of all future locomotives to have the boiler capacity at least equal to, and, if possible, somewhat in excess of, the maximum power requirements of the cylinders.

SUPERHEATER LOCOMOTIVES.

When properly maintained and efficiently operated, the superheater is by far the most valuable mechanical aid to fuel economy ever applied to locomotives. By its use savings of 20 to 25 per cent in coal and water are obtainable in actual service. But if maintenance is neglected and careless handling of the device in service is permitted, the superheater may become almost useless, as far as performing its regular function is concerned. The question of superheater operation is extremely vital to the subject of fuel economy, and should be given careful consideration.

The method of handling the throttle on superheater locomotives is of more importance than is generally realized. The best results are secured by the use of a full throttle opening, with reverse lever control as far as service conditions will permit, the exceptions being, when starting a train, when using a very small quantity of steam while running at high speed on low grade or level track, and when drifting.

There are several conditions which will tend to reduce the amount of superheat added to the steam while passing through the superheater, some of which indicate improper inspection and maintenance, while others are within the control of the enginemen. The principal causes of loss of efficiency in the superheater are as follows:

1. When water is carried at too high a level in the boiler, priming is apt to result. When this occurs, water is carried over into the superheater and the water has to be evaporated.

2. If the fire is in poor condition, due to improper or excessive firing, or to holes in the fuel bed, there is bound to be a drop in the temperature of the flue gas, which reduces the amount of superheat added to the steam.

3. Plugging up of superheater flues, failure of the superheater damper to work properly, or leaks in the superheater or in the front end, will impair the efficiency of the superheater.

It would appear that to insure obtaining the best results from the superheater, a temperature indicator showing the degree of superheat is desirable. Among those who have had experience with such pyrometers is quite a difference of opinion regarding their value as an aid to the enginemen in improving locomotive operation. Of those replying to the questions relative to experience with pyrometers on superheater locomotives nine replies were unfavorable to the use of the pyrometer, except perhaps for tests or for limited application for educational purposes, and six replies were entirely favorable to the application of the pyrometer to all superheater locomotives.

On the road with which the chairman of this committee is connected, some experimenting has been done with the pyrometer, both in regular road service and on tests. It was observed that the enginemen were very enthusiastic over the results obtained with the device, and, as a rule, the fireman watched the pyrometer gage much more closely than he did the steam gage. In spite of its apparent delicacy of construction and adjustment, the instrument maintained its setting quite accurately. While the committee is not prepared to say that the cost of applying pyrometers generally would be justified by the savings resulting from their use, the device is not without merit, and, as an educational feature, the cost of a few applications would undoubtedly be amply repaid.

INSTRUCTIONS FOR ENGINEMEN AND FIREMEN.

In order to obtain the best operating efficiency and the greatest amount of fuel economy, careful attention to two fundamentals is absolutely essential. The design of locomotives must be such that economy is obtainable, and the enginemen and firemen must receive suitable instruction in order that the desired economies can be realized.

Foregoing portions of the report cover, in a general way, those factors of locomotive design which have the greatest influence on fuel economy. [The committee also presented a standard Manual of Instructions for Enginemen and Firemen, which embodied all the essential points of efficient locomotive operation, and at the same time was brief and free from technical data.—Editor.]

The report is signed by:—Wm. Schlafge (Erie), Chairman; W. H. Flynn (M. C.); D. M. Perine (Penn.); Robert Quayle (C. & N. W.); S. G. Thomson (P. & R.), and D. J. Redding (P. & L. E.).

DISCUSSION

C. D. Young (Penn.): The committee has covered the ground of instructions to the road employes in a very complete and concise way. I move that this part of the report go to the association for letter ballot for adoption as recommended practice. It might be well for the executive committee to consider the advisability of publishing this portion of the report in some small booklet form, so that these copies could be procured by the small roads who do not care to have more elaborate instruction, and distributed to their road foremen and to the men.

(The motion was carried.)

D. J. Redding (P. & L. E.): I hope that the manufacturers of pyrometers may be able to bring out in the near future some pyrometer which will record its performance over the entire trip and which will be of sufficiently rugged design that it will be satisfactory for locomotive service. The committee speaks of starting the lubricator at least fifteen minutes before leaving time. I think that could be made clearer.

Lawford H. Fry (Baldwin Loco. Works): There is one point I think might be brought out in connection with the ratios given of fire-box heating surface to grate area, and total heating surface to grate area, and that is the volume of the fire-box. The value of the volume is indicated where it says "When bituminous coal is applied to the fire the volatile or gaseous matter is expelled, and, if properly mixed with air and heated to a sufficient temperature in the fire-box, the mixture will ignite." Both space and time are necessary for the ignition, and it is necessary to give proper volume as proper grate area. If we analyze the figures we see that the fire-box heating surface per square foot of grate area which is a rough measure of the volume of the box per square foot of grate area, to be 11.3 in 1903, and was reduced to 7.7 in 1913 for the bituminous locomotives, indicating that with the increasing sizes of the locomotives it is more difficult to keep up the fire-box volume. While it has become more difficult, the fact that it is desirable to keep up the volume, I think should not be lost sight of.

Mr. Schlafge: It was not the intention of the committee to draft hard and fast rules, because we know that that would

not be possible. What we intended doing was to start them out right, and we bore down on the fact that a good judgment was necessary, and that is necessary with everything. Now, we have got to meet these conditions as they come up, and I am a great believer in system. To me a system, be it ever so bad, is better than no system at all.

C. F. Baker: I think much more attention ought to be paid to the area of the air openings in the ash pans. I would suggest that either this committee or another committee make further investigation and report at the next convention on the proper area of air openings in locomotive ash pans.

SYMPATHY FOR MR. FOSTER

O. M. Foster, master mechanic of the New York Central at Collinwood, Ohio, recently lost his wife and daughter, and was badly injured himself, in an automobile accident. A motion was carried at yesterday's meeting conveying the sympathy of the M. M. Association to Mr. Foster.

UNIVERSITY OF VERMONT ALUMNI

Members of the University of Vermont Alumni held an informal luncheon at the Marlborough-Blenheim on Thursday. Those present were: H. B. Oatley, Locomotive Superheater Co.; M. C. Robbins, general manager of the Iron Age; H. H. Marsh, Railway Age Gazette, and G. M. Leach, Atlantic City Electric Co.

SOME FACTS ABOUT THE GOLF TOURNAMENT

Certain points regarding the golf tournament do not seem to be generally understood. One of the most important of these is that while there will be two contests, an 18-hole Medal Play handicap and an 18-hole Kickers' handicap, it will be necessary to play only 18 holes in order to take part in both of them. In other words, the player may enter both contests and have his score for 18 holes, if he plays only this many, apply in each of them.

First, second and third prizes will be awarded in each contest, the prizes all being sterling silver loving cups. The playing may be done at any time on Sunday. In case of ties in either contest, additional rounds will be played by those who are tied on either Monday or Tuesday of next week. Each participant in the tournament will have the privilege of selecting his own handicap in the Kickers' contest and the winning score will be the lowest between 71 and 76. All scores under or over these amounts will be disqualified. The Medal Play handicap awards will be based on the regular handicaps and resulting net scores of the players.

The following persons have entered the tournament up to the present time:

H. C. May	La Fayette Country Club
Charles A. Schroyer	Westward Ho
H. H. Kerr	Westmoreland
John B. Wright	Edgewood Country Club
C. C. Castle	Rockland Country Club
B A. Hegeman	Rockland Country Club
N. E. Chilcoat	Edgewood
T. W. Williams	Baltusrol
F. M. Nellis	Belmont Springs
W. K. Krepps	Wykagyl
R. C. Vilas	Glenview
Merrill G. Baker	Unattached
L. F. Deming	Whitemarsh
W. O. Kellogg	Woodbury Country Club
C. A. Raymond	Unattached
B. Pratt	Calumet
B. V. H. Johnson	Glen Echo
George E. Howard	Glen Echo
George T. Cooke	Englewood
J. S. Seeley	Calumet
J. E. Buker	Calumet
C. F. Palmer	Algonquin
Samuel O. Dunn	Westmoreland
Harold N. Scott	Chicago Golf
J. G. Tawse	Calumet
L. R. Dewey	Calumet
Prescott Dudley	Chicago Golf
Edw. E. Silk	Unattached
C. B. Field	Evanston
G. H. Musgrave	Commonwealth
H. M. Perry	Jackson Park
C. J. Olmstead	Unattached
S. G. Downs	Unattached
C. C. Farmer	Unattached
E. Quincy	Salesbury
H. R. Newlean	Jackson Park
L. E. Jones	Belmont
B. P. Flory	Orange Co.
D. R. MacBain	Shaker Heights

THANKS FROM THE ENTERTAINMENT COMMITTEE

The Entertainment Committee desires to extend a sincere vote of thanks to Ernest Shackelford, manager of the Pier, for the thorough manner in which he has co-operated with the committee in its work. Never before has there been so little difficulty in keeping the public off the Pier, notwithstanding the innovation of excluding outsiders for all five nights instead of only two, as in former years.

ADDITIONAL MASTER MECHANICS' REGISTRATION

Allen, C. W., Shelburne.
Allen, G. S., P. & R.; Pennhurst.
Arter, W. D., Supvr. Apprent; N. Y. C.; Traymore.
Arden, D. D., Sav. & States B.; M. M.; Baltimore.
Ayers, A. R., Prin. Asst. Engr.; N. Y. C.; Blenheim.
Best, W. N., Marlborough.
Bingaman, C. A., A. E. M. P.; P. & R.; Albemarle.
Blunt, James G., Amer. Loco. Co.; Traymore.
Bowles, C. K.; M. M.; Tidewater & West.; Monticello.
Burton, T. D., Blenheim.
Bussing, G. H., S. M. P.; Mex. No. West; Haddon Hall.
Butler, F. A., M. M.; Boston & Albany; Alamac.
Brazier, F. W., S. R. S.; N. Y. C.; Blenheim.
Cooper, F. T., Hobart & Allfree Co.; Dennis.
Dillon, S. J., M. M.; P. R. R.
Ewald, Wm., S. M. P.; Cumb. & Pa.; Ebbit House.
Fitz Simmons, E. S., Mech Supt.; Erie; Blenheim.
Fry, L. H., Supt. of Product, Stand. Steel Wks.; Shelburne.
Freeman, L. D., Supt. Shops, S. A. L.
Gill, C A., G. M. M.; B. & O.; Holmhurst.
Gordon, H. D., Jenkins Bros.; Blenheim.
Gray, B. H., S. M. P.; N. O. M. & C.; Traymore.
Coddington, H. W., Engr. Tests, N. & W.
Harrington, H. H., M. M.; Erie; Dennis.
Hoke, H. A., Asst. Engr. M. E. Dpt.; P. R. R.; Dennis.
Irvin, I. B., Gen. For.; P. S. & N.; Lexington.
Kendig, R. B., Ch. M. E.; N. Y. C.; Blenheim.
Lanza, G., Conslt. Engr.; Dennis.
Laux, J. P., M. M.; L. V.; Arlington.
McManamy, John, M. M.; Haddon Hall.
Meade, P. J., M. M.; A. C. L.; Chalfonte.
Milliken, Jas., S. M. P.; P. B. & W.; Brighton.
Montgomery, Wm., M. M.; C. of N. J.
Moses, F. K., M. M.; B. & O.; Lexington.
Montgomery, Chas., M. E.; P. M.; Dennis.
Muhlfield, J. E., Conslt Engr.; Blenheim.
Murray, F. H., M. M.; Erie; Alamac.
Murray, E. A., M. M.; C. & O.; Blenheim.
Murray, E. A., M. M.; C. & O.; Blenheim.
Mullinix, S. W., Supt. Shops, Rock Island; Dennis.
Pattison, R. C., M. E.; W. & L. E.; Chalfonte.
Pickard, F. C., M. M.; D., L. & W.; Traymore.
Quereau, C. H., Supt. Elec. Eq.; N. Y. C.; Blenheim.
Ralston, J. A., M. E.; U. P.; Dennis.
Reagan, F. H., Supt. Shops; D., L. & W.; Blenheim.
Riley, S. B., Gen. For.; West Mary.; Haddon Hall.
Rummey, T., Dennis.
Shull, G. F., M. M.; C. C. & O.; Traymore.
Smock, F. A., M. M.; P. R. R.
Snyder, W. H., M. M.; N. Y. S. & W.; Alamac.
Stuart, Charles M., M. M.; P. & R.; Pennhurst.
Street, Clement F., Loco. Stoker Co.; Blenheim.
Stewart, A. F., M. M.; C. & O.; Traymore.
Thomson, H. R., M. M.; Newb. & S. S.; De Ville.
Thibaut, Geo., M M.; Erie; Lexington.
Trout, W. S., Gen. For.; West. Mary.; Holland.
Turner, Amos; M. M.; L. V.; Arlington.
Warnock, H. R., S. M. P.; West. Mary.; Traymore.
Webster, H. D., M. E.; B. & L. E.; Traymore.
Wiggins, C. H.; S. M. P.; B. & M.; Blenheim.

ADDITIONAL MASTER CAR BUILDERS' REGISTRATION

Brazier, F. W., S. R. S.; N. Y. C.; Blenheim.
Bussing, G. H., S. M. P.; Mex. No. West.; Haddon Hall.
Coddington, H. W., Engr. Tests; N. & W.; Traymore.
Ewald, Wm., S. M. P.; Cumb. & Pa.; Ebbit.
Fitz Simmons, E. S., Mech. Supt.; Erie, Blenheim.
Gray, B. H., S. M. P.; N. O. M. & C.; Traymore.
Grewe, H. F., M. M.; W-P. Term; Sterling.
Hogsett, J. W., Ch. Joint Car Insp.; Chalfonte.
Irvin, I. B., Gen. For.; P. S. & N.; Lexington.
Kendig, R. B., Ch. M. E.; N. Y. C.; Blenheim.
Laux, J. P., M. M.; L. V.; Arlington.
Milliken, James, S. M. P.; P. B. & W.; Brighton
Muhlfield, J. E., Consult. Engr.; Blenheim.

Schroyer, C. A., Supt. Car. Dept.; C. & N. W.; Chalfonte.
Turner, Amos, M. M.; L. V.; Arlington.
Warnock, H. R., S. M. P.; West. Mary.; Traymore.
Waldo, B. M., Ch. Interc. Insp.; Chalfonte.

ADDITIONAL SPECIAL GUESTS

Arnold, Harry M., Clerk, P. & R.
Benz, Robt., For.; P. R. R.
Bicler, H. C., Asst. Supt.; P. R. R.; Seaside.
Bower, T. T., Asst. Efficiency Engr.; B. & O.; Dennis.
Brown, George, P. R. R.
Brown, Jas. R., Ch. Cl. Traf. Dept.; B. & O.; Dennis.
Bugg, B. L., Asst. Gen. Mgr.; A. B. & A.; Blenheim.
Campbell, J., M. M.; L. V.; Traymore.
Chaffee, W. D., M. M.; N. Y. C.; Dennis.
Copeland, T. T., Rd. For. of Eng.; Union; Dennis.
Culver, C. N., For.; C. of N. J.
Dampman, W. M., For. Eng. House, P. & R.; Clarion.
Davis, G. L., Gen. Mgr.; Pond Creek Coal Co.; Seaside.
Dugan, G. A., For. Round House, P. & R.
Eldridge, Geo. P., P. & R.
Endy, Wm., Str. Keeper, P. & R.
Entrekin, Thos., Str. Keeper, P. & R.
Engard, Albert C., U. S. Navy; Bothwell.
Farrington, R. J., Gen. Piece Wk. For.; P. & R.
Farrington, A. R., Insp. Piece Wk.; P. & R.; Strand.
Fleming, H. L., Gen. For.; B. & O.; Brevoort.
Frazee, Wm. H., P. R. R.; Colonial.
Gilhausen, F. R., Gen For.; B. & O.; Lexington.
Grooten, M., M. E.; Imperial Russian Rys.; Brighton.
Gramm, Rush, Engineer, B. & O.; Lyric.
Guinand, H. W., Insp. Material, P. R. R.
Haines, W. S., M. M.; Erie; Continental.
Heinbach, W. F., For.; P. & R.; Larchmont.
Hewitt, E. F., Gen. For.; P. R. R.
Hill, Jno. P., Gen. Stork.; W. J. & S.
Holliday, James, Shop For.; A. C. L.; Monticello.
Howe, L. C., A. B. Insp.; P. & R.
Hunter, J. F., Asst. Supvr.; W. J. & S.
Hukill, H. O., Retired Pur. Agt.; Brighton.
Huston, F. T., A. M. M.; Penna. Lines; Dennis.
Joyce, Michael, Engineer, P. R. R.
Kauffman, G. B., Pass. Agent, Atl. City Ry.; Grand Atlantic.
Kilborn, J. E., Pur. Agt.; Rutland; Blenheim.
King, John H., Ch. Clerk, N. Y., O. & W.; Phillips House.
Kulp, C. J., Treas.; L. V.
Lane, R. H., Insp. Test Dept.; Southern.
Linvill, J. M., Engineer, N. Y. C.; Sterling.
Little, D. A., For.; P. R. R.; Rudolf.
MacAlpine, J. D., Trav. Acct.; N. Y. C.
Mayer, F. A., Gen. Mast. B. M.; Southern; Pennhurst.
Markland, W. H., Gen. Shop Insp.; P. R. R.
Mull, Russell H., P. & R.; Sterling.
Murphy, J. W., For.; Boston & Albany; Schlitz.
Munick, J. L., For. Office Mech. Engr.; P. R. R.; Dennis.
McGowan, G. W., Gen. For.; S. P.; Lexington.
Nelson, W. G., Jr.; Equip. Insp.; P. R. R.
Neale, F. A., Gen. For.; C. of N. J.; Pennhurst.
Ogilvie, James, Mech. Expert, Board of Ry. Coms.; Alamac.
Poole, E. P., Supvr. Loco. Piece Wk.; B. & O.; Strathaven.
Rankin, W. E., For.; P. & R.; Bothwell.
Rice, Wm. L., Gen. For.; P. & R.; Monticello.
Rhoads, J. J., Supt.; P. R. R.
Rhodes, R. S., N. Y. C.; Runnymeade.
Riedinger, L. P., Gen. For.; P. R. R.
Rohrback, M. P., For. Round House, P. R. R.; Continental.
Russell, R. B., Gen. For.; P. & R.; Osburne.
Schofield, W. B., Asst. to Pres.; D. & H.; Blenheim.
Schechter, L. H., Ch. Engr.; Russia Loco. & Mach. Corp.; Blenheim.
Schum, H. S., For. Round House, P. R. R.; Continental.
Shepp, D. F., P. & R.
Smith, R. M., Asst. Rd. For. Engs.; P. R. R.
Smith, M. E., Sig. Engr.; D., L. & W.; Shelburne.
Smith, W. M., For. Round House, P. & R.; Whittle.
Strauss, I. H., Secy. to S. M. P.; C. & O.; Shelburne.
Stull, H. W., Gen. For.; P. & R.; Dennis.
Stewart, M. D., For. Erect. Shop; So.; Monticello.
Talbot, F. J.; Ch. to Mech. Supt.; Erie; Chalfonte.
Vought, H. D., Secy.; N. Y. C.; R. R. Clubs; Blenheim.
Vorhees, T. C., Jr.; Asst. to Prest.; P. & R.; Traymore.
Walsh, C. E., Asst. to Pur. Agt.; Penna. Lines; Brighton.
Wilt, W. L., Ch. Cl. to S. M. P.; Penna. Lines.
Wilson, J. M., Gen. For.; P. & R.; Miller's Cottage.
Wilson, Wm. C., P. & R.; Miller's Cottage.
Winterstein, John, Loco. Insp.; I. C. C.; Arlington.
Zeigler, C. J., Ch. Electr.; Fla. East Coast; Dennis.

Conventionalities

B. W. Mudge is evidently out for blood in the golf tournament. He has wired Junior for his favorite "putter."

W. H. Forsyth, general manager of the Curtain Supply Company, has been detained, but is expected to arrive in Atlantic City on Saturday.

W. H. Wilkinson, of the Pressed Steel Car Company, was feeling pretty glum until he learned that his side partner, Jack Turner, would sure be here on Sunday.

E. L. Grimm, Chief Draftsman, Northern Pacific

The Hunt-Spiller sextette, under the leadership of Walter B. Leach, certainly look good in their holdovers. Wonderful what a little sponging and pressing will do!

H. Rauch, general foreman of the New York Central at Avis, Pa., is leaving Friday night to attend a flag raising at the Avis shops. The celebrated apprentice band will give a concert.

Left to Right—H. E. Passmore, Grip Nut Company, and Willard Kells, Asst. S. M. P., Atlantic Coast Line

Owing to business reasons and sickness some members of the entertainment committee are unable to be here. In consequence the chairman, George R. Carr, is obliged to do an unexpectedly large part of the work. It is another case

of "Let George do it," and there is no question that he and his able lieutenants on the committee who are here are entirely equal to the task.

Hugh Montgomery is not with the Bangor & Aroostook as indicated in yesterday's *Daily*, but as his many friends know is superintendent motive power and rolling stock of the Rutland.

Left to Right—J. C. Little, Mechanical Engineer, C. & N. W., and S. A. Boone, General Chairman, Brotherhood of Locomotive Firemen, C. & N. W.

George Thibaut, recently appointed master mechanic of the Erie at Port Jervis, is attending the convention for the first time. He was formerly general foreman at Susquehanna.

Frank Huffsmith, formerly superintendent motive power of the International and Great Northern, sends greetings to his

Left to Right—H. M. Brown, Shop Supt.; J. R. Gould, S. M. P.; and H. C. Gillespie, Master Mechanic (All of the C. & O.)

friends at Atlantic City and says that Palestine (Texas) now has the best of hotel accommodations.

The *Atlantic City Review* says, "A Massachusetts farmer claims to have a horse with a wooden leg. The Greeks once presented the Trojans with a horse which had four of them." He must have hit the sawdust trail and stopped to graze on the way.

A large railroad in the west finding its files cumbered with letters that were long-winded and full of circumlocution issued an order, commanding brevity. The first fruit of this was a telegram from a section boss. He said: "No. 5 didn't whistle; send new handcar."

G. W. Lillie, mechanical superintendent, second district, Chicago, Rock Island & Pacific, located at Topeka, Kan., is accompanied by Mrs. Lillie. He reports a bumper wheat crop in his district and believes that if the weather remains favorable it will surpass the excellent crop of last year.

George S. Goodwin, mechanical engineer, Chicago, Rock Island & Pacific, who so clearly established the value of a

F. P. Pfahler, Inspector I. C. C., and His Son Fred

locomotive at the Western Railway Club last winter, is here for the M. M. convention. Mr. Goodwin was elected a member of the executive committee of the club at its last meeting.

Frank H. Harrison, of W. L. Brubaker & Bros., was added to the enrollment committee to take the place of Dick Sawyer who could not attend the convention. The change was made at the last moment, which accounts for Mr. Harrison's name not appearing as a member of the committee in Wednesday's daily.

G. T. Depue, Shop Superintendent, Erie

F. W. Kiesel, Jr., assistant mechanical engineer of the Pennsylvania, says that the Pacific type locomotive, Class K-4-s, which was exhibited at last year's conventions, is in service on the Pittsburgh division and giving excellent results. No more of these locomotives have as yet been built, however, as it has been found that the engines of the Atlan-

tic type, Class E-6-s, can successfully handle all the present trains. A large number of the Mikado locomotives, Class L-1-s, are now in service and more are under construction at the Juniata shops.

George M. Basford has had a practical demonstration of the value of the bonus system, which has dispelled any skepticism he may have had on that point. He finds that everything depends on the size of the bonus, but says it

Grant W. Lillie, Mechanical Supt., Rock Island Lines

was really worth a dollar to have Howard Gray dress for dinner in six minutes. Gray says he can beat even this record if there is sufficient incentive.

J. F. De Voy, assistant superintendent motive power, Chicago, Milwaukee & St. Paul, will be greatly missed this year, especially on account of his severe illness. He underwent a major operation some time ago that evidently was not entirely successful, as he was again operated on last week. A. E. Manchester reports, however, that he is getting along very nicely and he fully expects a reasonably early recovery.

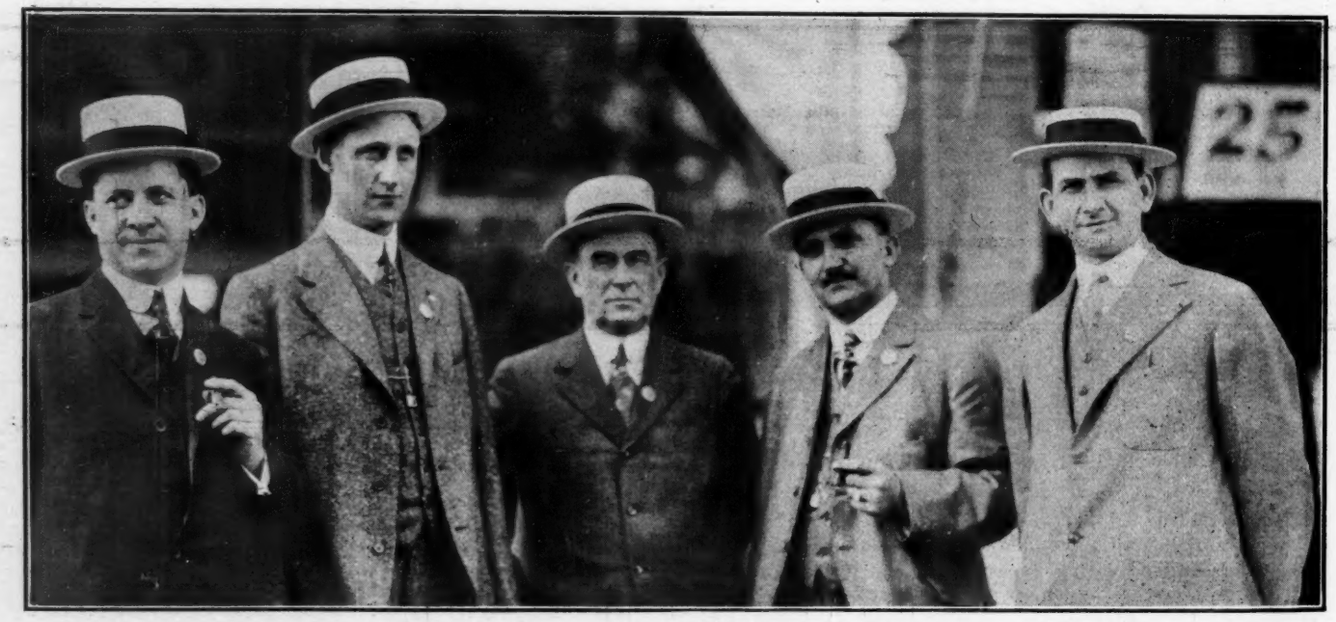
Cy Yardley is having considerable trouble in getting enough sleep. It seems that he has just adopted a little poodle, at his home in Caldwell, which necessitates his getting up at 5 o'clock every morning to let it out, after which he starts to work in his garden. In spite of all measures which he has taken he still continues to be an early riser at Atlantic City.

C. E. Postlethwaite, of the Pressed Steel Car Company, is a graduate of the Altoona (Pa.) High School, class of 1883. On his way to Atlantic City he stopped off at his old home town to attend a reception and entertainment in honor of Miss Linda E. Hooper, who had decided to retire after having taught in the school for 43 years. Interest in the affair was heightened by the fact that it was also a reunion of classes, every class since 1879 having been represented by former pupils.

The quotation "B. A. F. Y. D. F.," used in an advertisement in *The Daily* by his friend Bert Waycott, had been puzzling Harry Frost for some hours when he finally appealed to our copy service department for a translation. Not having written the advertisement; and not being familiar with the language that his friend might use in trying to induce a railway man to buy a Fulcrum, we pleaded ignorance, but suggested that perhaps it was something that needed an injection of formaldehyde.

W. D. Arter, who was supervisor of apprentices of the New York Central & Hudson River, now the New York Central east of Buffalo, has had his jurisdiction extended over the lines west of Buffalo which formerly made up the Lake Shore & Michigan Southern and the Chicago, Indiana & Southern. This adds about 225 apprentices to those under Mr. Arter's jurisdiction, 125 of these being at Collinwood, 75 at Elkhart and 25 at Gibson. This makes the total number of apprentices on the New York Central 510.

William Schlafge, general mechanical superintendent of the Erie, is justly proud of the size of the contingent from that road at the convention this year. Besides Mr. Schlafge, there are included, E. S. Fitzsimmons, mechanical superintendent at New York; C. James, mechanical superintendent at Cleveland; W. C. Hayes, superintendent of locomotive operation, New York; R. B. Watson, engineer of tests, Meadville, Pa.; W. S.



Left to Right—M. W. Hassett, M. M.; J. G. Parsons, Supt. Shops; C. H. Hogan, Asst. S. M. P.; and A. J. Fries, Asst. S. M. P. (all of the N. Y. C.) and Fred Riegler, Machine Foreman, W. & L. E.

Cozad, superintendent apprentices and piece work; and H. E. Blackburn, apprentice instructor at Dunmore, Pa. All of the division master mechanics but three are at the convention, those present being F. H. Murray, Jersey City; W. H. Snyder, Stroudsburg, Pa.; W. S. Haines, Dunmore, Pa.; G. Thibaut, Port Jervis, N. Y.; H. H. Harrington, Susquehanna, Pa.; L. R. Laizure, Hornell, N. Y.; George Depue, Galion, Ohio; and J. Borden, Cleveland. All of the car shop superintendents will be here next week for the Master Car Builders' convention.

C. H. Andrus, Master Mechanic, Pennsylvania Railroad

Habit and custom play queer tricks on us. The editors of this paper are accustomed to dictating their copy. When working on *The Daily* they write most of it with pen or pencil; and sometimes, in the hurry of work, the untrained and unruly pens and pencils play queer tricks. Yesterday, one of them, while the man holding it was not looking, concluded a sentence regarding the fact that Mrs. Burton W. Mudge and son, Burton, Jr., were not at the conventions this year with the statement, "Mrs. Mudge decided to stay at

W. T. Kuhn, Supt. Motive Power, T. H. & B.

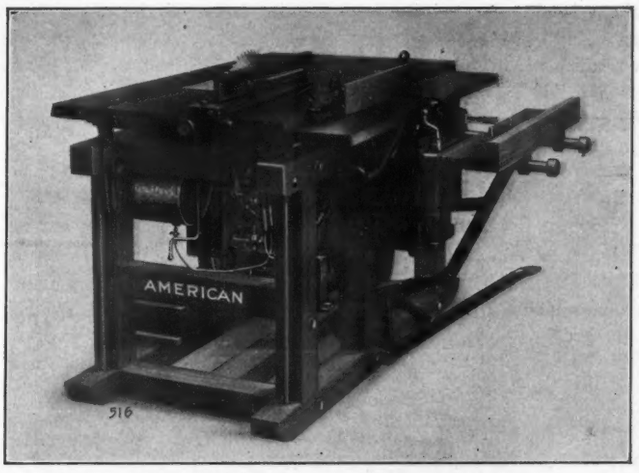
home with it." Needless to say, we were referring to Burton, Jr., in that sentence, and no one who knows that interesting young gentleman would think of referring to him in such an impolite way. This conventionality also is being written with a pencil. Do you see any "bugs" in it? We don't. If there are any, they are due to bad eyes and an ungovernable pencil. Meantime, we apologize to Burton, Jr.

VARIETY WOOD WORKER

A self-contained variety wood worker is on exhibition which will meet the requirements of many outlying car repair points where a variety of jobs are occasionally met with but where a completely equipped mill is not justified. The machine is self-contained; the frame being built up of seasoned hardwood, well bolted together, and contains either a complete gasolene engine outfit or an electric motor. It consists of a combined rip and cut-off saw bench with a boring attachment, a hollow chisel mortiser and a jig saw attachment. It also includes a six-inch jointer and dado head.

The top is a 54 in. by 30 in. iron casting accurately planed and strongly hinged to the rear of the frame. It is readily raised and lowered by a hand screw and may be firmly clamped in any position. It is independent of the jointer table, neither interfering with the other. The jointer has a steel cutter head fitted with two six-inch knives and slotted on two sides to receive matcher bits or molding cutters for working a large variety of shapes. The tables are 7½ in. wide by 43 in. long and are adjustable to any desired position. The jointer head is removable to permit the use of a sander drum.

The hollow chisel mortiser will work bits from ⅜ in. to ¾ in. The mortiser table has a vertical adjustment of 3½



Self-Contained Engine or Motor-Driven Variety Wood Worker

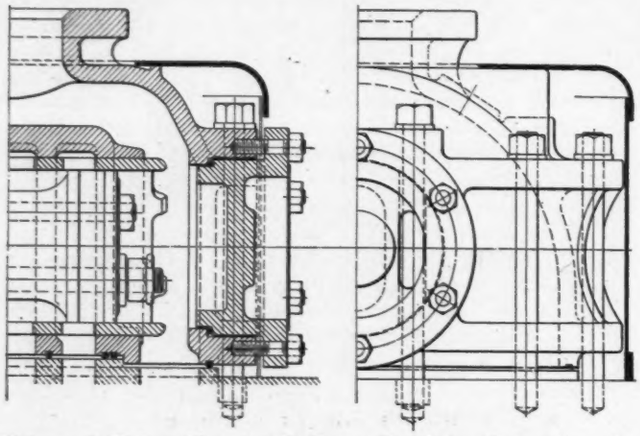
in. and a travel of 4 in. in line with the spindle. It is provided with a foot pedal for feeding the work to the bit and a coil spring for the return motion. By removing the mortising chisel and substituting a regular boring bit the mortiser may also be used as a boring machine.

This wood worker is built by the American Saw Mill Machinery Company, Hackettstown, N. J., and a motor-driven machine may be seen in operation at the booth of this company. The floor space required is 54 in. by 54 in. and the machine has a total height of 36 in. The arbor takes saws with a one-inch hole up to an outside diameter of 16 in. which is the largest that can be used. Without an engine the machine weighs 850 lb., the engine increasing this weight to 1,150 lb.; with a 5-hp. motor the total weight is 1,250 lb.

THE PART OF THE ORLEANS RAILWAY IN PROTECTING PARIS.—The Orleans Company last fall had to undertake the supplying of part of the entrenched camp round Paris. Up to September 30, it carried into the capital and its environs 117,000 tons of various commodities, 66 tons of forage, 107,000 beeves, and 211,000 sheep and pigs, while it had also to carry concurrently the daily supplies of men, horses, food and ammunition to the army and to bring back the wounded and prisoners from the front.

UNIVERSAL VALVE CHEST

The Economy Devices Corporation, New York, is exhibiting a universal valve chest for use in applying piston valves to slide valve cylinders, which has been altered to make possible the removal of the valve without disturbing the valve

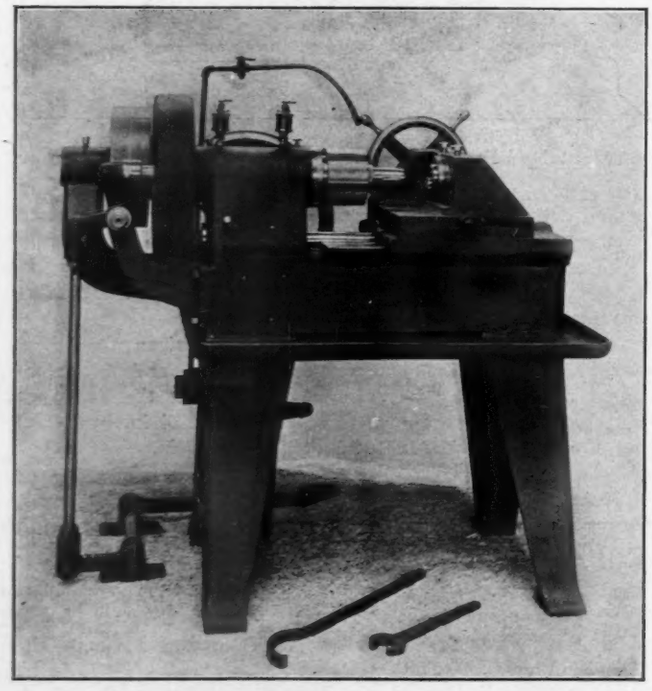


Universal Valve Chest with Front Head for Removing the Valve

chest itself. As originally built the front of the chest was provided with a hole large enough to allow the use of a wrench on the valve stem nut, this being closed with a plug, or a relief valve. The new type has a large opening in the front wall through which the valve may be removed, this being closed by a deep head secured with six studs.

EXPANDING AND BEADING MACHINE FOR INJECTOR PIPE COUPLINGS

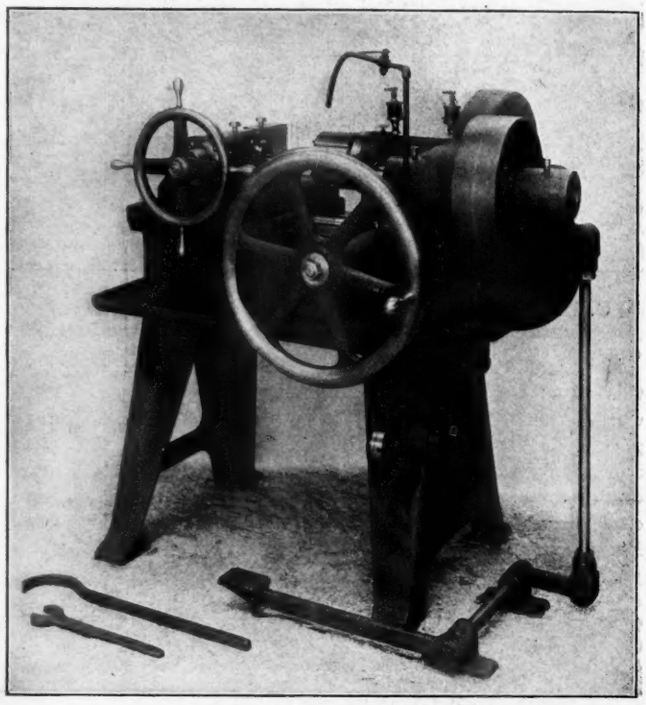
From a careful analysis of injector steam pipe failures it has been found that over 50 per cent are due to coupling sleeves failing. Recent reports of the federal bureau of



Rear View of the Expanding and Beading Machine

locomotive boiler inspection show that these failures continue to be one of the most frequent causes of serious accident and are the only ones which show an increase during the present fiscal year. The use of mechanical joints has been suggested as a means of eliminating this class of failures and is being used to some extent. The rolled and beaded joint eliminates the necessity for brazing and the consequent danger of injuring the pipe due to overheating. Defects in workmanship are readily discovered in such a joint, while the condition of a brazed joint is a matter of uncertainty and defective joints are often placed in service.

The expanding and beading machine, illustrated herewith, is similar to the machine described in a paper on Dimensions for Range and Screw Couplings for Injectors, read before the American Railway Master Mechanics' Association last year, by O. M. Foster, master mechanic, New York Central, but differs in the method of control. It is designed for rapid and economical application of coupling sleeves to copper pipe ranging from one inch to three inches in diameter and will handle pipes having short U or S bends. The



Operating Side of the Expanding and Beading Machine

time required to apply a sleeve is claimed to be much less than that required for brazing, with the additional advantage that the finished connection is much safer.

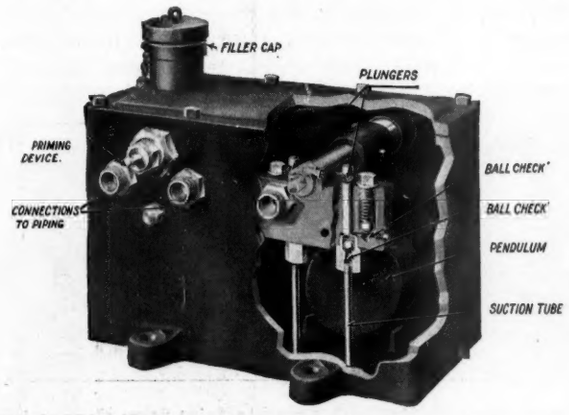
The pipe is clamped in a movable chuck, with its end facing a roller expander attached to the spindle of the machine. After placing the coupling sleeve over the end of the pipe the chuck is moved forward by means of a hand wheel and screw feed until the expander enters the pipe. The rollers are then expanded by means of a conveniently located foot pedal; the end of the pipe is beaded by a further forward movement of the stock. The beading tools are interchangeable for the ball and socket members of the coupling.

As regularly furnished this machine is adapted for either belt or motor drive. The regular equipment includes a countershaft, wrenches and one set of chuck jaws and tools for applying sleeves to one size pipe. Tools for additional sizes are furnished extra. The floor space occupied is 3 ft. by 4 ft. and the machine weighs 1,650 lbs. A metal cutting power saw may be had as an attachment to the expanding and beading machine for cutting off and squaring the ends of the pipe. The expanding and beading machine is being exhibited at the booth of H. G. Hammett, Troy, N. Y.

AUTOMATIC FORCE FEED FLANGE OILER

A flange oiler fed by an automatic pendulum pump has been developed by the Detroit Lubricator Company, Detroit, Michigan. It consists of an oil tank or reservoir and the feed nozzles on the flanges; the tank contains the pumping mechanism and is connected to the feed nozzles by the necessary piping, in which are placed the regulating valves and check valves which control the flow of oil to the flanges.

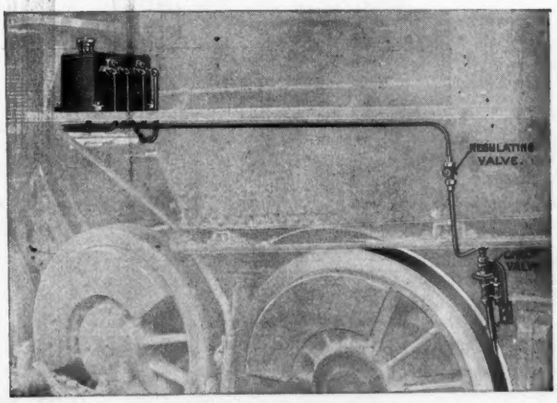
The tank may be placed in any convenient location and is so installed that the pendulums swing in a plane at right angles with the engine frame or boiler. Any swinging motion or rolling on curves, or lateral motion of any kind,



Broken Section of the Oil Tank Showing Details of the Pendulum Pump

causes the pump to operate. The oiler shown has four feeds and the tank contains two pumps, one for each two feed tubes. Each pump is operated by a pendulum which is sensitive to the slightest movement, any lateral motion of the locomotive causing it to swing. The pendulum shaft is pinned to a transverse rod, the ends of which engage the two plungers, and its swinging results in alternate up and down strokes of the plungers in the pumping unit.

On the up-stroke of a plunger oil is drawn up past a ball check; on the down-stroke it closes the passage into the



Force Feed Flange Oiler with Automatic Pendulum Pump

suction tube and oil is forced past another ball check into the pipe leading to the feed nozzle. Another check valve is located in the pipe line just above the feed nozzle. This is held to its seat by a spring which does not release until a predetermined pressure is reached in the pipe line, when it recedes from its seat and permits the oil to flow down the feed nozzle and onto the flange. After the pump is once in operation and as long as there is oil in the tank this pressure between the ball check in the pumps and the check valve above the feed nozzles is constantly maintained, consequently any swinging of the pendulum immediately forces oil to the flanges.

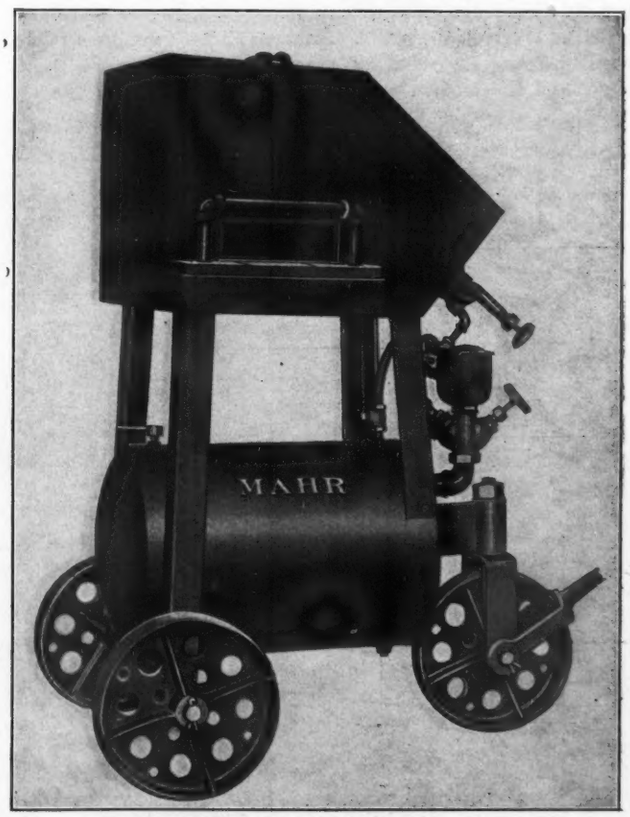
In order that the pump may supply oil to the flanges immediately after being installed a priming device is provided by means of which the pendulum shaft may be oscillated from the outside of the tank. It consists of a small rod extending through the side of the tank on the center line of the shaft. A tongue on the inner end of this rod engages a groove in the end of the shaft, the parts being normally held apart by a coilspring.

The regulating valves are installed in the pipe lines just above the feed nozzles and are within easy reach. Each valve controls the amount of oil that is fed to the flange and is regulated by the operator to meet the particular requirements of each individual installation. This device installed on a working model may be seen in operation at the Detroit Lubricator Company's exhibit.

PORTABLE RIVET FORGE

The portable rivet forge shown in the illustration has recently been added to the line of the Mahr Manufacturing Company, Minneapolis, Minn., and is included in its exhibit on the pier. The furnace is provided with combustion and heating spaces, so arranged that a minimum amount of scaling of the rivets takes place. It is built up of steel and all corners are welded; there is a removable cover on the upper inclined surface. It is lined with standard fire brick, the interior being readily accessible for this work.

The burner is designed to use crude oil, tailings, distillate or kerosene oil and operates on any air pressure from 10 lb. up to 125 lb. per sq. in. The tank which has a capacity



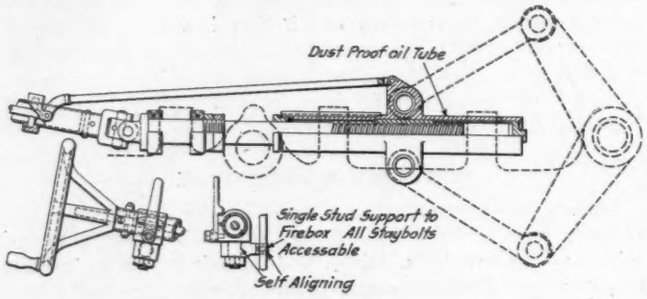
Portable Rivet Forge with Welded Frame

of 18 gal. is provided with a filling funnel and an oil measuring gage. It is welded to the frame by which the furnace is supported and forms a part of the truck frame. The wheels have wide tires to facilitate handling the outfit when using it about repair tracks. A chain is attached to the hood of the forge for use in moving it about the shop with a crane.

YOUNG VALVE GEAR, REVERSE GEAR AND VALVE

The Pyle-National Electric Headlight Company, Chicago, has in operation at its exhibit a full-sized model of the Young locomotive valve gear, including piston valves of an unusually light design, and a screw reverse gear designed to meet the special requirements of this valve gear. This valve gear was introduced about two years ago,* the most notable feature of the motion produced being the long travel of the valve. Several changes have since been made in the method of transmitting the motion across the engine.

The motion in this gear is derived entirely from the cross-

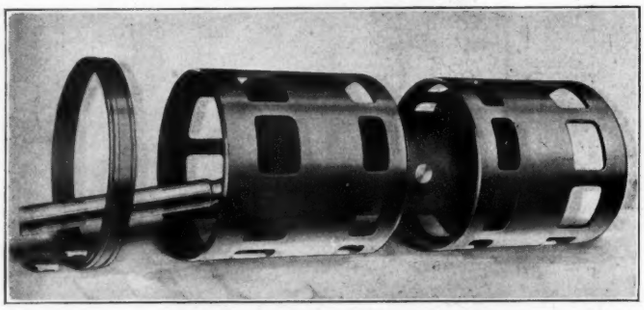


Details of the Screw Reverse Gear

head connections and the 90-deg. movement necessary for the main travel of the valve is obtained by means of a pair of interlacing rockers, concentrically mounted, each with a bearing on the other rocker at one end and in the valve-gear frame at the other end. As shown in the drawing, these rockers transmit the variable component of the motion from the crosshead and link on one side of the engine to the lap and lead lever on the other. Each link thus swings in unison with its own crosshead and the lap and lead, or fixed component of the motion for each valve is taken from the top of the link on its side of the engine. The link block is made with integral trunions, which make possible a reduction in the size of the block as well as in the size and weight of the link.

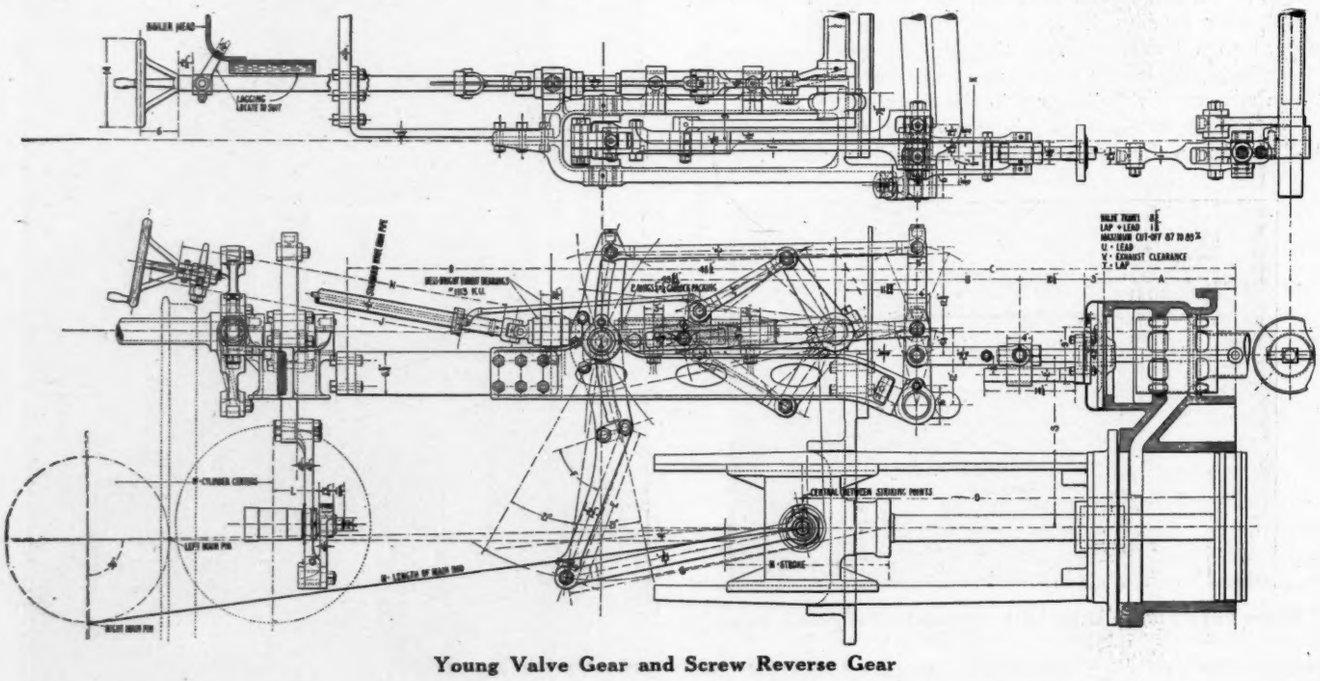
A maximum valve travel of 8½ in. is obtained with this gear, with a total angle of oscillation for the link of only 42 deg. The entire weight of the gear on both sides of the engine, including the gear frames and the reverse gear, is 3,013 lb. The moving parts constitute less than half of the total, their weight being 1,484 lb.

The reverse gear is of the screw type, and is supported directly on the valve gear frame. The screw is immersed in a dust-proof oil tube, within which the nut is so secured that it may be readily removed for renewal. A packing gland in the end of the tube provides for the movement of the tube on the rod without the loss of oil or the entrance of dust. The operating rod is of pipe, and is universally jointed to the screw. The hand wheel support is a block pivotally secured to a single stud tapped into the side or corner of the firebox. This provides a universal adjustment for readily maintaining the operating rod in perfect alignment, and leaves the staybolts accessible. The rod is free to move longi-



Young Piston Valve with Knuckle Joint Stem Connection

tudinally in the supporting block, which is split on one side, and to it is attached a hand-operated lever, by which it may be clamped to secure the rod in any desired position. The cut-off is thus unaffected by the expansion of the boiler. A graduated cab indicator projects through the center of the hand wheel, which shows the exact cut-off of the gear in any position.



Young Valve Gear and Screw Reverse Gear

The piston valves used with this gear reverse the usual packing ring arrangement. The valve is a light cylinder, cast in one piece, and of uniform thickness throughout. The ends are of a hollow, cylindrical form, somewhat resembling the bushings applied to the usual type of valve chamber. The rings are stationary and are recessed into the walls

*For a description of the original gear, see the *Railway Age Gazette, Mechanical Edition*, January, 1914, page 43.

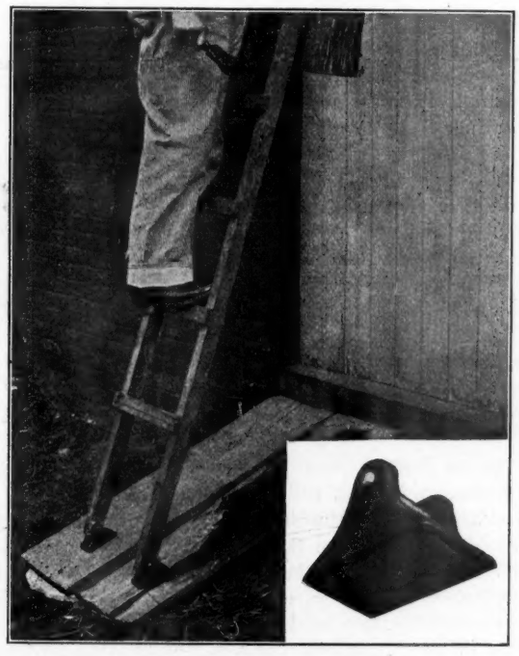
of the valve chamber on either side of each cylinder post, the outer surfaces of the valve ends being in sliding contact with them. The operation is thus similar to that of a plug valve, and the weight of the valve is materially reduced by the elimination of the bull rings and followers necessary with a ring-packed valve.

Another feature of interest in the construction of this valve is the method of making the valve stem connection. The end of the valve stem is provided with a knuckle, which is secured to the center of the valve spool by a fitted pin. It is thus possible for the valve to properly align itself regardless of the alignment of the stem, and a source of much unequal wear to the valve and the packing rings is thus eliminated.

These valves weigh but 100 lb. each. The long travel of the valve obtainable with the Young gear permits the use of a valve of comparatively small diameter without sacrifice of steam admission area. The valves in this case are 12 in. in diameter, which, in itself, effects a reduction, this being still further increased by the construction of the valve.

DEVICE TO PREVENT LADDERS FROM SLIPPING

A hinged shoe for application to the bottom of ladder string pieces has been devised by the American Mason Safety Tread Company, New York, to reduce the danger of accidents caused by the slipping of the ladders on the floor. The bottom of the shoe, which comes in contact with the floor, is faced with a coarse carborundum grit which possesses exceptional gripping qualities and is claimed to hold



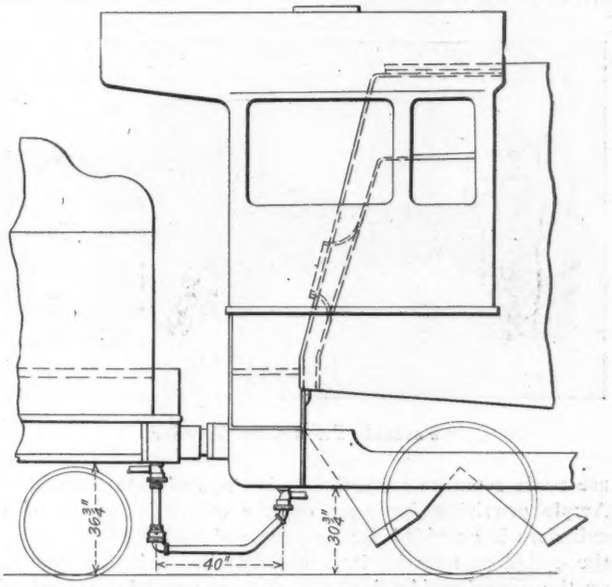
Ladder Shoes to Prevent Slipping

firmly even to the smoothest of concrete or steel floors. The shoes, it will be noticed, are swiveled to the ends of the ladder string pieces, thus permitting the base of the shoes to lie flat against the floor regardless of the angle at which the ladder is placed. This device is being exhibited at the booth of the manufacturer.

ROLLED STEEL PISTONS.—Included in the exhibit of the Carnegie Steel Company, Pittsburgh, Pa., are a number of rolled steel sections of various kinds manufactured at its Slick works. Among these are two styles of forged and rolled steel pistons for locomotive cylinders, which are of especial interest at the present time because of the increasing tendency toward the reduction in weight of reciprocating parts.

FLEXIBLE WATER CONNECTIONS

The Barco Brass & Joint Company, Chicago, is exhibiting this year a flexible water connection for use between engine and tender, which was recently redesigned to reduce the number of nipples and pipe fittings required in setting it up. As now designed, it permits a combination of the swivel and angular motion of the ball, and all of the joints are hung in a vertical position, so that the ball tends to maintain a full bearing against the surface on the gaskets by gravity.



Flexible Water Connection with Vertical Members

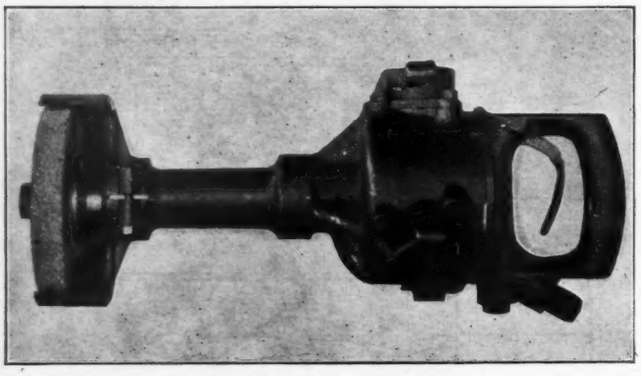
The entire connection is suspended by bolts from plates under the engine and tender, to which the joints are attached by means of integral flanges. The long leverage of the horizontal connection prevents any severe thrust or shock being transmitted to the joints due to the vertical motion between the engine and tender. An angle ball is used on the engine end in order that the pipe may not revolve around the axis of its own thread, thus obviating the danger of its coming unscrewed, which would exist if a straight ball were used with an elbow and vertical pipe connection. A patent has been applied for.

LOHMANNIZED BOILER TUBES.—Several specimens of Lohmannized boiler tubes are on exhibit at the booth of the Parkesburg Iron Company, Parksburg, Pa. These tubes have been subjected to a pickling process in a special chemical bath after which they were dipped in a lead and antimony alloy. This process gives to the metal an alloy coating which cannot be physicially separated and experimentally has proven impervious to the action of acid and alkaline solutions; nor has it developed any electrolytical affect which might be detrimental to other parts of the boiler. These tubes are intended for use in feed-water heaters and condensers where excessive corrosion takes place.

WHEEL PRESS AND LOCOMOTIVE GAGES.—General improvements have been made in the devices exhibited by the Ashton Valve Company, Boston, Mass. Among these is a wheel press recording gage, which is furnished with a glass pen of the capillary style. This makes a very fine line and produces a satisfactory record. The gage is also furnished with ruled record charts, which are an improvement over the plain paper records previously used. A steam gage is also being shown which is provided with a white porcelain enamel dial. Each dial is graduated to conform to the individual movement in the gage in order to insure accuracy.

PORTABLE GRINDER

The illustration shows a recently developed portable pneumatic grinder, in the design of which simplicity and accessibility of the parts has been carefully considered. In order to eliminate unnecessary parts the valve is made part of the crank shaft and all valve motion parts are thus dispensed with. The handle is secured to the cyclinder casing by six cap screws the removal of which exposes the entire interior for inspection. The motor is designed especially for grinding work and runs in an oil bath. The cylinders



Portable Pneumatic Grinder

are made separate from the casing to facilitate replacement. Ample provision for wear on the exposed corners of the cylinders is provided for by pads and as they become worn the cylinders may be interchanged thus bringing the pads on the opposite sides into use. The exhaust is covered with an adjustable deflector. The grinder is being exhibited by the Ingersoll-Rand Company, New York, and many of the details, including the piston and connecting rod connections, are of the standard type embodied in the line of "Little David" pneumatic tools manufactured by this company.

CARBON-VANADIUM FORGING STEEL

To meet the need of greater strength in material for locomotive axles and forgings, the railroads have turned to heat-treated carbon and heat-treated alloy steels. One obstacle to the adoption of heat-treated forgings, however, is the lack of equipment for heat-treatment in most railroad shops. This operates particularly in repair work where for any reason the forging has to be locally heated, thereby destroying the effect of the heat-treatment.

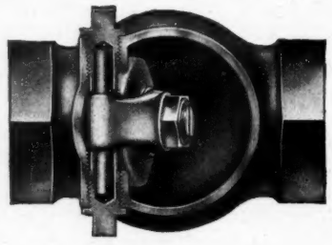
Many motive power men and producers of locomotive forgings believe that it is extremely desirable to obtain a steel of moderate cost that, without heat-treatment other than annealing to toughen and refine the grain, will have physical properties equal to those specified for heat-treated carbon steel forgings. With the reduction in the cost of vanadium that has taken place during the last year the American Vanadium Company resumed the investigation and study of the application of vanadium to simple carbon forging steels, which was dropped about 12 years ago on account of the high price of vanadium. At that time some tests were made on the effect of vanadium in simple carbon steels and a very considerable increase in strength was found to result. The effect of vanadium on alloy steels such as chrome steels was, however, so much greater that development proceeded with these steels rather than the simple carbon steels.

As the result of its latest investigations this company has developed a type of simple carbon-vanadium steel which is said to meet all the requirements specified for heat-treated carbon steel forgings, without heat-treatment other than annealing, these results being obtained from steel of lower carbon content than is generally required to obtain the specific physical properties of the heat-treated material. In annealing forgings of this material it is recommended that they be heated uniformly to a temperature of 1,425 deg. to 1,475 deg. F. and then removed from the furnace to cool in air, protected from strong drafts and rain or snow.

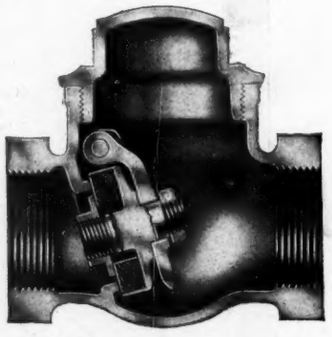
Still better results can be obtained by annealing, as this material may be subjected to heat-treatment with results which are said to approximate those obtained from more expensive alloy steels. The treatment consists of first heating to a temperature of about 1,600 deg. F. and quenching in oil. The forgings should then be drawn back to about 1,100 deg. or 1,150 deg. F.

SWING CHECK VALVE

A check valve offering a full opening free from obstruction and with practically no pocket at the bottom of the body has been added to the line of Jenkins Bros., New York, and is on exhibit at their booth. This valve is fitted with a renewable disc and is supplied with either a semi-hard composition especially adapted for hot water service in boiler feed lines and returns, or with a soft pliable composition for use with cold water or air.



By referring to the illustration it will be seen that the hanger pin is carried and held in place by two long plugs inserted in the sides of the body, and has a long bearing both in the plugs and in the hanger. By unscrewing the cap and plugs the hanger pin may be removed and the disc and hanger lifted out of the valve. The bodies are made for either screwed or flanged connections in sizes from ¼ in. to 3 in. inclusive and the valves are perfectly adapted for use in either horizontal or vertical positions.



Swing Check Valve

HORIZONTAL BORING, DRILLING AND MILLING MACHINE.—A new model horizontal boring, drilling and milling machine is being exhibited by the Lucas Machine Tool Company, Cleveland, Ohio. This machine differs from the previous model only in size and capacity. The spindle has been made larger and the total traverse increased from 48 in. to 52 in. The vertical capacity has been increased 6 in. to a total of 30½ in. and the platen has been increased in width. It now has six T-slots instead of four as formerly.

METALLIC PACKING MATERIAL.—The Lubricating Metal Company, 2 Rector Street, New York, is exhibiting a bearing metal and metallic packing, which are being introduced in railroad service after nine years of successful use in rolling mills, cement plants and general bearing and packing work. It is claimed that this material, known as Noheet metal, has an elastic limit of 10,000 lb. per sq. in. as against about 6,500 lb. per sq. in. for genuine babbitt and lower for other metals, and a tensile strength of 13,500 lb. per sq. in. As it contains no antimony, copper or spelter it has a uniform testure and is claimed not to score shafting or rods. It has a low coefficient of friction and, on account of its natural lubricating properties, is said to require less oil than other bearing metals.